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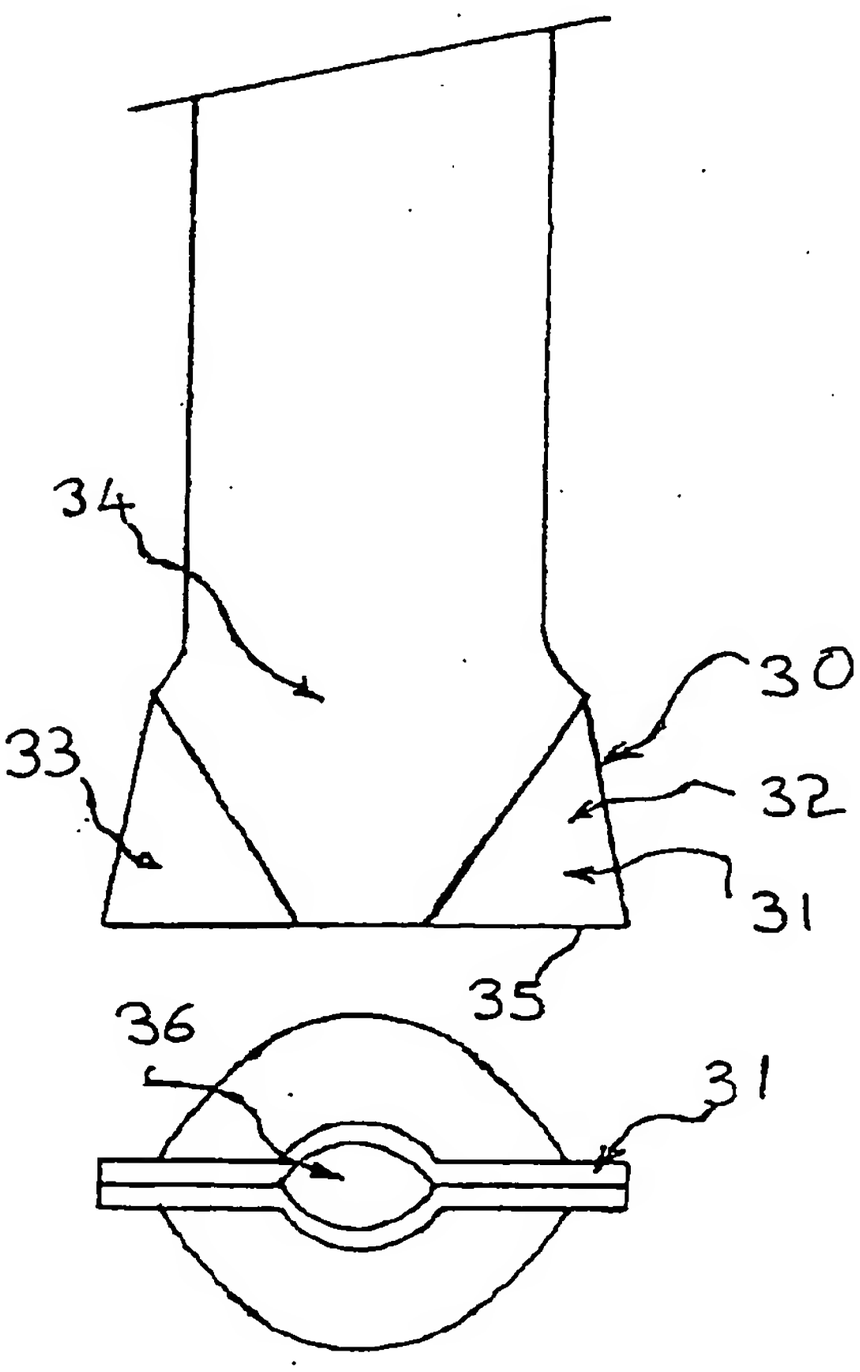

(57) Abstract: An earth anchoring member (30) having an upper body portion and a lower ground engaging portion having opposed side faces, a flattened insert end (31) with a leading edge, a raised portion extending from each said face, each raised portion tapering towards and terminating at the insert end and two opposed ground retaining flanges (33, 35) which extend outwardly from the upper body portion and terminate at the leading edge.

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METHOD AND APPARATUS FOR EARTH ANCHORING

FIELD OF THE INVENTION

The present invention is directed towards a method and apparatus for fixing structures such as posts into the ground. The invention is particularly suited, though not limited, to fencing and building applications, road side markers and sign posts.

BACKGROUND OF THE INVENTION

In the past, typical fencing methods have involved digging a hole to a suitable depth, filling the hole with concrete and then inserting a fence post which is eventually fixed in the hole upon the concrete setting. Alternatively, the posts are directly inserted into holes in the ground followed by backfilling with the soil displaced by digging the hole.

There are a number of problems with such approaches, in particular digging of holes is labor intensive, as is providing the concrete for the holes. Further, posts set in concrete are difficult to remove and/or replace. Replacement may be necessary if a post becomes damaged or if a fence line needs to be relocated. Where no concrete is used, and the hole is simply backfilled with displaced soil, a post is supported by loosened soil, which must be compacted. Insufficient compaction of surrounding soil, or loose and sandy soil can result in the post leaning to one side during the course of its life.

In order to overcome the difficulties associated with inserting posts into dug holes, posts which can be hammered or driven into the ground have been proposed. In order to facilitate driving into the ground, it is desirable that the post presents a small surface area to the ground. It is also common to provide the post with a leading point to facilitate driving of the posts. However, the degree of lateral force which can be resisted by a post is dependent upon the cross sectional area of the post. For example, a timber fence post with a cross section of 300mm is much more resistant to lateral forces when compared to fence post of about 30mm. Thus, posts having a narrow cross section and which are easy to drive into the soil are subject to tilting or leaning over time. Further, a post having a narrow width of constant

cross section when encased in soil, has no means other than gravity and friction between the earth and the post to provide a hold down force to the post. This disadvantage applies to both solid posts and hollow posts formed from a length of pipe.

In order to address this difficulty there have been numerous proposals, most of which are directed towards increasing the surface area of the post or a post anchor which is in contact with the soil. Typically, the lower or ground engaging portion of the post or anchor is provided with extending fins or the like. A disadvantage with providing fins is that they require welding of the fins to the post. Such a procedure requires multiple welding steps and results in a fairly expensive article. One example of a post anchor of this type is a product recently marketed under the brand name IMPACT POST. This product makes use of an anchor 10 as depicted in Figure 1 which is hammered into the ground by means of a power tool without need for a hole. The anchor comprises four fins 12 which make contact with the earth. The anchor includes a collar adapted to receive a fencing post. One problem with this system is that there is a tendency for the anchor 10 to loosen over time and consequently the post fixed to the anchor to tilt.

A further approach is to provide a post or post anchor with an auger in which the post or anchor is screwed rather than driven into the soil. These types of devices also suffer from being complicated and expensive to manufacture. Further they require special tooling for screwing the auger into a ground surface. A further disadvantage with augers is that the screwing motion loosens the surrounding soil. Loosened soil cannot have the same retaining forces as more compacted soil.

It is therefore an object of the invention to provide a post or anchor therefore which may at least partially overcome the above disadvantages or provide the public with a useful choice.

SUMMARY OF THE INVENTION

According to a first broad form of the invention there is provided an earth anchoring member having an upper body portion and a lower ground engaging portion, the ground engaging portion having a leading edge, and

opposed ground retaining flanges which extend at least initially outwardly with respect to side walls of the body.

The member of the present invention has an upper body portion which typically extends at least partially from a ground surface when the member is driven into the ground. The upper body portion may be of a sufficient length such that it can function as a structural member, fence post, road marker, signpost or the like. Alternatively, the upper body portion may be engagable with a structural member. Such an arrangement is particularly suitable in the cases of signs, barrier members or the like which may periodically need to be replaced due to damage. In this case, the structural member may be replaced by simply disengaging the existing structural member from the upper body portion and engaging a replacement structural member. It will be appreciated that this procedure does not require removal and replacement of a post from a ground surface.

In a further broad form of the present invention, there is provided a structural member assembly, the assembly including the earth anchoring member or the first broad form, a structural member and means for engaging the anchoring and structural members.

The structural member may be manufactured for engagement with the anchoring member. Typically, the assembly further includes an engaging member such as a bracket to which a conventional structural member may be attached. The engaging member may be integral with or engagable with the anchoring member.

The ground engaging portion of the anchoring member has a leading edge. The ground engaging portion may be wedge shaped, the wedge tip forming the leading edge. The wedge may be formed by squashing the end of a hollow pipe in a press. Alternatively, the anchoring member may be formed by shearing the end of a hollow pipe in order to form a wedge with a pair of flanges towards either end of the wedge tip. Typically the wedge has convexly curved outer sides.

In order to facilitate entry into the soil, the ground engaging portion may include a leading tab which terminates in the leading edge. The tab may

be a separate metal piece welded to the compressed end of a pipe. However it is preferred that the tab is integral with the ground engaging portion. This avoids stressing at the weld point during driving of the member.

In a particularly preferred form of the invention, a hollow pipe is pressed at one end to form the ground engaging portion. The pipe is typically pressed with a shaped dye which produces a ground engaging portion having a flattened leading end, a region of unpressed material on the front and rear faces, and retaining flanges extending from either side of the unpressed sections. The shaped dye may be substantially V shaped, arcuate, semicircular or the like.

Compressing the end of the pipe in this manner provides a leading edge having the maximum possible width. By having the tab and leading edge the fullest possible width, the retaining force of the earth on the tab can be maximized. However, in some cases, the tab may have a pointed leading edge to facilitate insertion into the ground. It will be appreciated that the shape of the tab and leading edge may be varied to suit different situations such as soil type and the types of stresses to which the anchoring member and any structural member attached thereto will be subjected to.

The ground engaging portion includes two opposed retaining flanges. The flanges initially extend outwardly from the body of the member. Typically the flanges terminate at the leading end (in the case of a ground engaging portion having a tab) or the leading edge. Typically, the flanges will extend outwardly continuously towards the leading end or edge. Alternatively, the edges of the flanges may initially extend and then become parallel.

The present inventor has surprisingly and unexpectedly discovered that an anchoring member of the present invention when inserted into the soil at a depth at which the retaining flanges are below the ground surface has a greater resistance to upwards and/or lateral displacement than conventional posts and in particular hollow pipe posts. Whilst not to wishing to be bound by theory, it is believed that during insertion into a ground surface, the soil is around the ground engaging portion is displaced which causes compression of the surrounding soil. The "compressed soil: then expands in behind the

retaining flanges. This "expanded" soil is still under compression and this applies compressive forces to the external walls of the member. It is believed that it is the compressed soil behind the retaining flanges that applies the greatest hold down forces to the member.

Where the anchoring member is to be used in conditions such as wet or sandy soil, it may be desirable for the anchoring member to include further ground engaging means. Such ground engaging means can include extensions such as fins, which increase the surface area presented to the ground. The fins may be welded to the side of the member. Alternatively, the body may have slots through which fins can pass. In this case, the fins would typically be activated to extend from the body after the member has been driven into the ground. Typically an anchor member of this embodiment will have one or two pairs of opposing fins.

The anchoring member may be driven into the ground by any suitable means. Typically, the anchoring member is adapted to be driven by a power hammer. Typically the anchoring member includes an adapter for placement between the anchoring member and a power hammer. In the event the power hammer is a jack hammer then the adapter may include a body having a recess for receiving a chisel of the jackhammer and an oppositely located recess for receiving the anchoring member. Preferably the adapter includes resilient inserts for locating the chisel in the body of the adapter.

During their life, posts are subject to various forces and stresses. Lateral stresses are experienced as a result of collision, winds and so on. The major stress concentration on a post occurs at ground level. For this reason, posts subjected to an over powering lateral force typically fail at ground level.

Further, metal posts are subject to corrosion. Corrosion is a particular problem for those posts exposed to moist or wet conditions. A particular problem with corrosion is experienced with metal fence posts in animal holding yards in which the base of the post is in contact with animal waste. As moisture from animal waste, rain, dew and the like resides mainly at ground level, that part of the post immediately above the ground level is

particular susceptible to corrosion. For this reason it has been considered beneficial to build up the surrounds of the post above ground level.

Another aspect of locating posts in holes is the cross sectional area of the post. As mentioned above, posts having a narrow width, which are encased in soil are reliant upon only gravity and friction to provide hold down forces. For this reason, narrow posts are conventionally set in concrete. By filling the hole with concrete, the cross section of the post acting in the soil is in effect made greater and this displaces more soil should the post be moved in any lateral direction. However, as mentioned above, setting of a post in concrete is time consuming, expensive and creates difficulties if the post needs to be removed and/or replaced.

In order to avoid mounting posts in concrete, it has been proposed to provide posts with ground engaging collars. A collar increases the effective cross sectional area of the post, as does a concrete footing. In order to optimize the ability of a collar to distribute lateral forces applied to the post, there must be a certain degree of contact between the ground and the collar. Thus by increasing the surface area of the contact area between the collar and the ground, lateral forces can be distributed more effectively. However, a disadvantage of known collars is that during application of a lateral force, the collar moves relative to the ground surface and displaces the surrounding soil. This results in the collar sitting loosely in the soil, which in turn can result in leaning of the post.

It is therefore a further object of the invention to provide a stabilizing collar for which may at least partially overcome the above disadvantages or provide the public with a useful choice.

According to a further broad form of the invention there is provided a stabilizing collar for a ground engaging member, the collar having an upper section, an aperture in the upper section through which the member can pass and be held and an outwardly curved stabilizing face depending from the upper section.

The present inventor has surprisingly and unexpectedly discovered that by providing an outwardly curved stabilizing face, lateral movement of the

collar when embedded in the ground lifts the soil rather then displacing the soil laterally. When the collar returns to its original position, the lifted soil can fall back in to its original position, thus reshaping the elongated hole so as once again to snugly fit around the collar. It will be appreciated that with some soils, the soil may not immediately fall back into place. However, replacement of the soil will normally occurs as a matter of course in response to traffic about the collar and/or waterfall.

The ground engaging member may be a structural member such as a post or an anchoring member for a post.

The upper section of the collar may be planer with an aperture located therein. The aperture typically corresponds to the cross section of the post so that the collar fits snugly about the post. Alternatively, the collar can include additional sleeves or the like which can be mounted within the main aperture. In this way, a single collar may be adapted to fit different sized posts.

A preferred collar of the invention has a sleeve which is engagable with the collar, the sleeve being upstanding from the collar and in use projects above the ground surface so as to cover the lower portion of a post. This sleeve can protect the base of the post from residual moisture at ground level. This can reduce corrosion experienced by metal posts.

The collar has an outwardly curved stabilizing face depending therefrom. Typically, the face is continuous about the upper section such that the stabilizing portion of the collar is dome shaped. Alternatively, the collar may include a plurality of faces depending therefrom which may be in the form of at least two arms members having curved faces.

The collar of the further broad form of the invention may be used with any suitable ground engaging member and is not limited to use with an anchoring member of the first broad form of the invention. However, an assembly comprising an anchoring member of the first broad form of the invention and a collar of the further broad form of the invention is particularly preferred.

In some situations it is preferable that the collar be mechanically connected to the anchor, for example by bolting or tek-screwing the collar to

the anchor. Such an arrangement helps to prevent downward penetration of the anchor into the earth in situations where downward force is applied to the anchor. Such a situation occurs where the anchor is used as a house stump.

As mentioned above, posts such as roadside guide posts, sign posts and the like need to be replaced from time to time as they are often damaged as a result of vehicular impact. At present, the most common type of road guidepost assembly is a simple wooden post sunk into the ground. In the event of a car colliding with such a post the timber may break so that it may not be reused. In some circumstances the broken post may be deflected as a projectile into the windscreen or floor of the vehicle, or onto the path of oncoming traffic. A further difficulty with guidepost of this type is that they need to be replaced after each vehicle impact. Furthermore they are subject to attack by termites and fire.

A further type of guidepost is the rigid metal post which may be constructed for example from aluminum or steel. Such posts deform on vehicular impact to reduce damage to vehicles and minimize risk personal injury. After impact the post will need to be straightened or replaced. Depending upon the conditions such posts are sometimes embedded in concrete. Replacement of such a post requires excavation to remove the concrete footing. This is time consuming and expensive. The design of the posts provides sufficient rigidity to resist bending by children but collapses with low resistance on vehicle impact.

Recycled rubber guide posts are also available. Such posts cannot be driven and must be buried. However, it is advantageous if the guideposts can be easily removed while maintenance is carried out on the road and then replaced again, Consequently the posts which require excavation in order to be installed are less desirable.

Although rigid guideposts are often cheaper in the short term, long lasting flexible guide posts can have lower whole of life costs, particularly when replacement and maintenance costs are considered. Rigid road edge guide posts are usually damaged upon impact. These guide posts are then inoperative until repaired or replaced.

In an attempt to address the problem or replacing damaged road side guide posts, it has been proposed to provide a guide posts assembly having a post anchor and upper guide member engagable therewith. The upper guide member is engaged to the post anchor by means of a shear pin. Upon impact, the shear pin shears and releases the guide member from the post anchor. In order to replace the guide member all that is required is for the guide member and post anchor to be re-engaged with a fresh shear pin. A disadvantage of such an assembly is that upon shearing of the shear pin, the upper guide member is completely released from the anchor and may become a dangerous projectile.

It is therefore a further object of the present invention to provide a post which may at least partially overcome the above disadvantages or provide the public with a useful choice.

According to a further broad form of the invention there is provided a post assembly operative to yield during impact, the assembly including a base, a post member, connecting means for connecting the base to the post member, the connecting means including collision release means and post member retaining means, whereby upon impact, the collision release means fails so that in use the post member can yield in response to the impact and the post retaining means retains connection with the post member.

In use, the base of the assembly is typically located at about ground level. In the event of a collision with a vehicle, yielding thereby occurs at about ground level which allows the vehicle to pass over the post. The base of the assembly may include a pair opposing side walls between which an end of the post member may be suitable connected. The base may form or be adapted to be engagable with a ground anchoring member. The anchoring member may be the member of the first broad form of the invention. Alternatively the base may be attachable to a support surface such as concrete, bitumen or the like. Suitably, a base member may be simply bolted to the support surface.

The post member may be in the form of an elongate post constructed from any suitable material including metal timber or a recycled plastics

product. The post member may also be in the form of a post connecting member which typically connects to the base end of an elongate post. Provision of a post connecting member allows posts of various types and sizes to be fitted to a single base member. Further, where the post is formed from timber it is preferable that a post connecting member be used and further that the post connecting member can resist splitting of the base of the timber post during impact. Typically the post connecting member includes a pair of opposed reinforcing plates secured at the end of the post. The opposed plates may be connected by a member located beneath the bottom of the post, for example they may be the side-walls of a channel. In one embodiment, the opposed plates are connected to the post by nailing. Alternatively they may also be attached by other connecting means such as bolting.

Conveniently, the collision release means is formed by at least one collision release member which will mechanically fail when subjected to a predetermined force. Where the assembly is for use as with road guide posts or street signs, the predetermined force corresponds to a light collision with a vehicle but exceeds those forces against which the post is subjected to during normal use. Typically, the release means is formed by a shear member such as a shear bolt, shear nail or shear pin. Typically, the shear member has a first end which makes a connection between the post member and the base and is operative to shear off in a collision thereby destroying the connection and allowing the post member to yield. It is not necessary that the collision release member completely disconnects the post member and base, all that is required is that the collision release member to deform sufficiently to allow the post member to yield.

The assembly also includes a post retaining means which retains at least some connection between the post member and the base. In this way, during vehicle impact, the post member or a post attached thereto may not become a projectile. In one form of the invention, the same member can provide both the post releasing means and the post retaining means. An example of such an arrangement is where the member is a shear member

having first and second ends connected by a shank, each end connecting the post member to the base. The first end is adapted to shear during a collision in which the force of the impact is substantially parallel to the shank such that the shank bends in the direction of impact and the second end retains the connection between the post member and the base. The assembly may include one or more such shear members.

Alternatively, the post release and post retaining members are two discrete members. In this case, members are located on opposing sides of the assembly, the post releasing member being located on the same side of the assembly as the site of impact and the post retaining member is located on the side of the assembly remote from impact. The post member is pivotally connected to the base by the post retaining member. The post release member in its normal position prevents the post member from pivoting. Upon impact, the post releasing member fails, thereby allowing the post member to yield by pivoting about the post retaining member. Typically, the post release and retaining members are pins, nails or bolts. Typically, the members are substantially identical such that either member is subject to failure, depending upon which side of the assembly, the impact occurs.

In an especially preferred form of the invention, the release and retaining members are shear members having first and second ends connected by a shank. Impact in the direction normal to the shanks will result in shearing of the member closest to the point of impact with the member remote from the site of impact remaining intact. Impact may also occur with the force being substantially parallel to the shanks. In this case, it is preferred that each shear member is able to shear at one end and deform at the other end in the manner as defined above. In this case, the assembly includes at least two shear members.

In use, after an impact the post member yields without damage to the post. In order to return the post to its original upstanding position, all that is required is to remove and replace the sheared or deformed post release and retaining members. In this way, posts can be re-used almost indefinitely, which reduces replacement costs together with being environmentally

acceptable. Further, returning the posts to their original position can be accomplished quickly and with minimal skill. Digging up and replacing posts is thereby avoided.

BRIEF DESCRIPTION OF THE FIGURES

Figure 1 is a fencing post anchor as known in the prior art;

Figure 2 is a preferred earth anchoring member of an embodiment of the present invention;

Figure 3 is a front plan view of the earth anchor of Figure 2,

Figure 4 is a side plan view of the earth anchor of Figure 2;

Figure 5 is a front plan view of a further preferred earth anchor of an embodiment the present invention;

Figure 6 is a side plan view of the earth anchor of Figure 5;

Figure 7 is a side and bottom end view of a further preferred earth anchor of an embodiment of the present invention;

Figure 8 is a front view of a further preferred earth anchor of a preferred embodiment of the present invention;

Figure 9 is a side view of the earth anchor of Figure 8;

Figure 10 is a front view of a further preferred earth anchor of an embodiment of the present invention;

Figure 11 is a side view of the earth anchor of Figure 10;

Figure 12 is a front view of a further preferred earth anchor of an embodiment of the present invention;

Figure 13 is a side view of the earth anchor of Figure 12;

Figure 14 is a front view of a further preferred earth anchor of an embodiment of the present invention;

Figure 15 is a side view of a further preferred earth anchor of an embodiment of the present invention;

Figure 16 is a side view of an upper body of a further preferred anchor of an embodiment of the present invention.

Figure 17 is a schematic view of a further preferred earth anchor according to an embodiment of the present invention;

Figure 18 is a schematic view of the earth anchor of Figure 17 in use;

Figure 19 is a partially exploded view of a lifting assembly used to test fixing of the anchor of Figure 17 in the ground;

Figure 19 is a front view of a further preferred anchor of an embodiment of the invention;

Figure 20 is a front view of a further preferred earth anchor of the present invention;

Figure 20a is a detail of a ground engaging member for use with the anchor of Figure 20;

Figure 21 is a view of the earth anchor of figure 20 in the in use position;

Figure 22 is a front view of a preferred post assembly of an embodiment of the present invention;

Figure 23 illustrates an adapter which allows a jackhammer to be used to apply force to an earth anchor according to an embodiment of the present invention;

Figure 24 illustrates a detail of the adapter of Figure 23;

Figures 25a and 25b depict the effect of excessive side forces applied to a fence post anchored in the ground;

Figure 26 is a plan view of a preferred stabilizing collar of an embodiment of the invention;

Figure 27 is a sectioned front view of the collar of Figure 26;

Figure 28 is a schematic view of a further preferred collar of the invention in use;

Figure 29 is a perspective view of a preferred post assembly operative to yield upon impact according to an embodiment of the present invention;

Figure 30 is a front plan view of the assembly of Figure 29;

Figure 31 is a front plan view of the assembly of Figure 29 immediately subsequent to the application of a collision force Ft;

Figure 32 is a front plan view of the assembly of Figure 29 at a further time subsequent to the application of collision force Ft;

Figure 33 is a front plan view of a further preferred assembly according to an embodiment of the present invention;

Figure 34 is a perspective view of still a further preferred assembly of an embodiment of the present invention;

Figure 35 is a perspective view of a further preferred assembly of an embodiment of the present invention;

Figure 36 is a plan view of a further preferred assembly of an embodiment of the present invention;

Figure 37 is a detail of part of the assembly of Figure 36;

Figure 38 is a detail of part of the assembly of Figure 36;

Figure 39 is a detail of a base which may form part of a preferred post assembly according to an embodiment of the present invention;

Figure 40a is a perspective view of a further preferred post assembly according to an embodiment of the present invention;

Figure 40b is a side view of the post assembly of Figure 40a after a collision and

Figure 40c is a further side view of the post assembly of Figure 40a after a collision.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

Figure 2 is a perspective view of a hollow galvanized pipe 22 as is frequently inserted into concrete filled holes for use as a fence post. However, unlike conventional pipes, the bottom ground engaging portion 23 has been shaped to form a convex sided wedge 24. Ground retaining flanges 26, 28 extend beyond the diameter of the pipe 22 on either side of wedge 24. A plan view of the sheared pipe of Figure 2 along the direction indicated by arrow A is shown in Figure 3. A plan side view of the sheared pipe along the direction indicted by arrow B in Figure 2 appears in Figure 4.

A very convenient method of forming the wedge and flanges of Figure 2 is to cut off by means of a mechanical sheering machine, a lower portion of a standard post as depicted in Figure 2. A further method for forming the earth anchor is to compress a lower portion of a standard post which produces a flattened projection or tab 7 from the apex of the wedge 6 as shown in Figures 5 (plan view) and 6 (side view). In use this tab facilitates insertion of the end of the anchor into the ground.

With reference to Figure 7 there is depicted a front and end view of the ground engaging portion 30 of a modified version of an earth anchor which includes a starting tab 31 on the base of the anchor. The tab 31 is formed by pressing the end of a hollow section of pipe with a V shaped press dye. This creates the shape shown in Figure 7 in which an unpressed curved section 34 has opposed flanges 32, 33 extending therefrom. By pressing the pipe in this manner, the leading edge 35 can reach its maximum possible width but also gives a strong cross section and minimizes the stress concentration where the tab 31 is first formed. This minimization of stress is advantageous as the point at which the tab is most likely to bend, should a rock or hard earth be struck, the tab will want to bend at this point.

The tab 31 is provided with an opening 36 which may be necessary if the anchor is to be hot dipped galvanized. The presence or absence of this opening 36 has no effect on the performance of the anchor.

The present inventor has observed that during insertion into a ground surface, the tab compresses the soil. This compressive action tends to bounce the driven anchor back out of shallow hard holes. The present inventor has also observed that by lengthening the tab, the bouncing effect could be minimized. However, if a tab was too long, it was more likely to bend should the anchor be driven into rocky and hard ground. Surprisingly and unexpectedly, it has been discovered that a ground engaging portion formed by pressing the end with a shaped dye so as to leave an unpressed portion provides a ground engaging portion having a leading tab which reduces the tendency for the tab to bounce back during insertion and at the same time providing a tab which is relatively strong so as to resist bending during use.

Figures 10 and 11 illustrate an alternative ground engaging portion 40 of a further anchor of the present invention. The ground engaging portion has been formed by pressing the hollow end of a pipe with a V shaped dye along press line 41 to form a tab 42. Figures 12 and 13 illustrate a further ground engaging portion 43 which has been formed by pressing with a semicircular dye.

It will be noted that the tab of an anchor of the invention may also have a pointed end as shown in Figures 8 and 9 which illustrate a further ground engaging portion 45 of an anchor has a tab 46 with a pointed end 47. A pointed tab may provide easier insertion into the earth than a tab with a wide end. Consequently, a single operator may be able to install the anchor with a sledgehammer rather than a power hammer such as a jack hammer.

It should be noted that the full possible width of the flattened tab section is not achieved if a pointed tab is used. Therefore the retaining force of the tab is not maximized as is the case with the tabs of Figures 7 and 10 to 13. Figure 14 illustrates the ground engaging portion 50 of a further preferred anchor in which the corners 51, 52 of the tab 53 are cut off to facilitate penetration of the earth while at the same time a broad section 54 is also provided for the application of retaining force by the earth.

A further variation of a ground engaging portion 60 of an anchor is shown in Figure 15. This anchor 60 has also been formed from a section of hollow pipe, but the end of the pipe has been split and folded back to produce anti-lift tabs 61 which can provide better hold down properties and is particularly suitable for use in sandy soils.

The upper body portion 62 of a further preferred anchor is shown in Figure 16. The upper body portion 62 is provided with opposed fins 64, 63. These fins can prevent or minimize lateral movement in soft ground such as soft soil, mud and sand.

With reference to Figure 17, there is shown an anchor 70 having a ground engaging portion 71 with a leading edge 72 similar to that previously described. Anchor 70 has a closed top 73 with a hole through which an operation bolt 74 is located. A working nut 75 threadingly engages operation bolt 74. Extending from the sides of working nut 75 are fins 76, 77 which pass through slots 78, 79 in the sides of the anchor body 80. As a quality control aid the anchor body 80 can be marked with color coded circumferential markers 81, 82. In operation, anchor 70 is driven into place such that the upper band is buried. The anchor is typically driven for example by means of a jackhammer. Once in place, operation nut 74 is rotated in

order to raise working nut 75 so that fins 76, 77 are forced out of the anchor body into the surrounding compacted soil 83 as shown in Figure 18.

In some circumstances it is desirable to check the resistance to lifting forces afforded by anchor 70 once it has been placed in the ground. With reference to Figure 19, there is depicted a lifting assembly 90 including a body 91 having a closed top section 92 with a hole therethrough to accommodate lifting bolt 94. Lifting bolt passes through an inner pipe 96 which has oppositely located vertical slots 98. A lifting nut 100 threadingly engages bolt 94 within pipe 96. Cross bars 102 extend from lifting nut 80 through vertical slots 98 in the side of pipe 96 also through vertical slots 104 in the side of body 90.

In use, lifting assembly 90 is placed over installed anchor 70 and tek-screws are screwed through holes 106 of inner pipe 96 and into the body of anchor 70. (Tek screws are galvanized, hardened steel, nut headed screws having a leading drill portion and a threaded screw portion). By applying a rattle gun or spanner to the head of the lifting bolt 94 the lifting nut, which is prevented from rotating by means of crossbar 102, climbs lifting bolt 94. As the lifting nut moves up bolt 94 it takes with it inner pipe 96 thereby transmitting shear forces to the tek-screws which engage anchor 70. At some point, the tek-screws attaching inner pipe 96 to the anchor 70 will shear. If the second band 82 of anchor 70 has not been raised above ground level at the point the tek-screws shear then it may be said that the footing has tested safe to application of a lifting force specified by the number of tek-screws used to attach the inner pipe to the anchor.

Figure 20 illustrates a further preferred anchor 110. The anchor 110 has a ground engaging portion 111 and a leading edge 112 as described above. An operation bolt 114 extends through the body of the anchor 110. An elongate lug 115 is located at the lower end of bolt 114. The anchor includes a ground engaging member 116 which is shown in more detail in Figure 20a. The member 116 is substantially U shaped with a base 117 and opposing arms 118, 119 extending from the base 117. A longitudinal slot 120 is located in base 120. Lug 115 can be aligned with slot 120 so as to pass

therethrough. Rotation of bolt 114 and attached lug 115 through 90° locks bolt 114 to member 116.

Two opposed upwardly inclined channels 121, 122 are located in the body of anchor 110.

In use, the anchor 110 is typically first driven into the ground. Bolt 114 with member 116 attached is inserted into the hollow body of anchor 110. Nuts 124 on bolt 114. The arms 118, 119 are biased outwardly such that they are forced towards each other by contact with the inner walls of the body of the anchor. As the bolt 14 is pushed downwards, nut 124 keeps member 116 in position at the end of the bolt 114. When the member 116 is in the position shown in Figure 20, the arms 118, 119 the bias of the arms allows them to spring apart so as to engage channels 121, 122.

The bolt 114 is then raised by a lever system or by winding nut 123 down onto a spacer (not shown). The method used, may vary, depending upon the firmness of the soil in which the anchor 110 has been driven. As bolt 114 is raised, lug 115 pushes upwardly against the base 117 of member 116. Arms 118, 119 become trapped in channels 121, 122 and are forced into the ground engaging position as shown in Figure 21. At this point the bolt 114 and lug 115 are rotated so as to disengage member 116 from bolt 114. Bolt 114 is then withdrawn from the anchor 110. The bolt may then be used to fit a further member 116 to a further anchor.

Figure 22 illustrates a post assembly 130 comprising an anchor 131 firmly fixed in a ground surface 132 and a fence post 133 attached to the anchor 131. The post 133 is secured to the anchor 131 by tek-screws 134. Other mechanical connection means such as bolting through the anchor may also be used. As an alternative the post may be glued to the anchor using a suitable adhesive. Although Figure 22 shows a fence post 133 fitted around the outside of anchor 131, post 133 could also have been fitted inside the anchor as the shearing end of the anchor produces a closed tip which does not allow entry substantial entry of earth.

With reference to Figure 23 there is shown a front view of a driving dolly or adapter 140 for transmitting force to an anchor. The upper face 142

of the dolly 140 is of suitably large area and solid construction to be hit with a sledge hammer. The dolly 140 includes hole 141 for locating the jackhammer. The hole 141 has a pointed end 143 sized to receive the "point" of the jackhammer. The purpose of this hole is to accept the impact forces of the jackhammer but to not damage the point. Figure 24 shows a front view of the upper part of dolly 140 and projected plan views 146, 147 of alternative plan views of hole 141. View 147 shows that the pointed end of hole 141 may be either round or hexagonal, depending upon the cross section of the jackhammer point used. View 146 will be discussed below.

As there are multiple sizes of jackhammer tools, the dolly 140 typically comes with a tool guide to be fitted about the tool to be used. The tool guide is forged around the jackhammer tool and then fixed in position in the dolly. This allows the tool to slide freely through the guide but does not allow the tool to rotate within it. This non-rotational restraint is important with the installation is a guide post anchor, where the rotational position guide post about its longitudinal axis, with respect to oncoming traffic, is of major concern to the user. With this dolly the user can steer the driven post anchor and achieve the final placement that is required.

If the dolly is to be used with a sledge hammer only, the dolly can be fitted with a "bulls eye" 146 (see Figure 24). This is a circular spirit level which is used to "plumb" the driven anchor. The bull's eye is fixed at the bottom of the uppermost hole in the dolly 140 and thus is not at any risk of being impacted by the sledgehammer.

Depending upon the size of the inner bore of the earth anchor to be installed, the dolly 140 is inserted into the earth anchor so that it rests against either lower surface 149 or lower surface 150. Force from a sledge hammer of jack hammer is then transmitted to the anchor thereby forcing it into the ground. The dolly 140 may be adapted to fit earth anchors having different size bores and scan be shaped to be suitable for anchors of any cross section, such as rectangular or square.

If an anchor is to be inserted into very hard ground, it might be necessary to put in a pilot hole first. If the user has a jackhammer, the point

can be driven into the ground to provide a pilot hole. If a sledgehammer is being used, the end of the dolly has been fashioned to a point 148, so that the dolly 140 can be driven directly into the soil or bitumen to provide a pilot hole. In extremes of conditions the pilot hole can be filled with water to soften the hole and reduce the coefficient of friction between the anchor and the soil.

In use, a difficulty which may be experienced by both conventional posts fitted into concrete holes and post assemblies of the present invention is that by applying a side force to a post, the post may fail at ground level. Figure 25a is a schematic view of a post assembly of the present invention which includes a ground engaging portion 151 and post member 152. The ground engaging portion has been driven into a ground surface 153. Application of a force in the direction of arrow A creates a concentration of stress at ground level to the side of the post opposite that upon which the force is applied. This results in failure of anchor 151 at ground level as shown in Figure 25b. In order to reduce the likelihood of this occurring a stabilizing collar may be placed about the post assembly at or immediately below ground level. Where the post is an assembly of the invention, the collar is typically placed around the upper portion of the ground engaging portion. Alternatively the collar may be used in association with a conventional post.

Figures 26 and 27 show a preferred collar 160 of the present invention. The collar 160 is circular in plan view. The collar 160 has an upper face 161 with an aperture 162 located therein. A continuos outwardly curved side wall 163 depends from the upper face 161.

The aperture 162 may be fitted with internal sleeves to allow the collar to be fitted to different sizes of post. The upper 161 and lower 164 faces of the collar 160 are complimentary which allows stacking of multiple collars. To facilitate stacking the ends of the curved face 163 are at an angle to the vertical.

Figure 28 illustrates a further collar 170 in use. The collar 170 has an upstanding sleeve 171. The collar is located below the ground surface 153. The sleeve 171 fits snugly about the upper section of the ground engaging

portion 151. The sleeve protects that part of the anchor 151 closest to the ground surface 153 from moisture. When a force is applied in the direction of arrow F^1 the collar disperses the stress concentrations which would normally be experienced by the anchor 151 at ground level. Restraining forces are applied in the directions of arrows F2 and F3. Movement of the collar displaces the earth. However, the outwardly curved face displaces the earth by lifting the earth. This earth can return to its original position when the collar returns to its original position. In this way, creation of a larger oval hole which results in tilting of a post may be avoided.

Figures 29 and 30 illustrate a preferred yielding post assembly 200 of the invention. The assembly 200 is shown connected to an anchor 22 similar to that illustrated in Figure 3. The assembly 200 includes a base 201 and a post member 202. The post member includes a wooden post 203 to which opposed metal reinforcing plates 214, 216 are bolted by means of three mild steel bolts 217A, 217B and 217C though other attachment means could also be used. In particular screwing is a preferred method as self-tapping screws may be used on site as they require no pre-drilling of the post. The lower end of post member is coupled to channel 213 of base 201 by means of three shear bolts 220A, 20B and 220C being members designed to selectively fail on the event of a collision as will be explained.

Anchor 22 is driven into the ground prior to connection of post member 202 and plates 214, 216. Although three shear bolts are shown in Figure 29, , other numbers of bolts could be used depending upon the specifications of the bolts.

Figure 30 is a front plan view of Figure 29 and shows nut 219C which secures bolt 217C in place and the head of shear bolt 221C. As will be known by those skilled in the art, the magnitude of shear causing failure of a bolt is highest at the shank and lowest at the thread. Accordingly in the event of a force Ft being applied in the direction 224 as shown in Figure 29, the likelihood of bolts 117A-117C shearing is reduced by orientating them as shown while the contrary applies to bolts 220A-220C.

In use the assembly 200 is mounted along the roadside so that force Ft

transmitted during a collision with an oncoming car will be likely to take the direction vector shown by arrow 224 relative to the assembly 200.

With reference to Figure 31, in the event of a collision, Ft produces a moment to be generated about edge P, being the top inside edge of channel 213 in the non-impact side of the post. This moment in turn causes plate 216 to exert a shearing force on the threaded ends of each of shearing bolts 220A-220C which causes them to break off so that they act as collision release means. Subsequently the shanks of shear bolts 220A-220C bend at each of their respective head ends. As the post 203 pivots bolts 220A-220C are retracted slightly out of through holes 226A – 226C of post 203 so that the bending radius of each of the bolts increases thereby reducing the tension in the shank and the likelihood of failure of the shear bolts at the head end. It can be seen that the head ends of the bolts function as post retaining means.

With reference to Figure 32, it will be noted that post member 202 is not destroyed by the collision but rather yields in a non-destructive fashion. Post member 202 remains loosely connected to base 201 and so cannot leave anchor 22 as a projectile as the remainder of bolts 220A-220C act to retain the post in association with base 201. Rather, any excess energy from the collision is transmitted to earth anchor 22 and absorbed by the ground or directly to the ground by the free end of the post coming into contact with the roadside.

Subsequent to the collision, the post assembly 200 may be reconstructed by simply lifting post member 202 off shear bolts 220A-220C. Post member 202 is then repositioned in channel 213 and coupled back into place with a new set of shear bolts.

Figure 33 shows a further yielding post assembly 240 wherein plates 214, 216 have been replaced with a post member in the form of a U shaped bracket 230 with post 203 locating above the top of the channel so that shear bolts 220A-220C pass through the space between the bottom of the bracket 230 and the bottom 231 of post 203. An advantage of this arrangement is that holes do not have to be drilled through the post for bolts 220A-220C. By arranging the channel relative to the post so that the lower end of the post

pushes against the shear bolt the likelihood of the post separating from the assembly during a collision is reduced.

With reference to Figure 34, there is shown a further variation of a yielding post assembly where base 201 incorporates nail holes 232 so that the base 201 can be nailed to post member 230. Rather than using shear bolts, shear pins or nails 237 may be used. An advantage of pins or nails is that there is no concern that the thread may be damaged during installation, A further benefit is that nuts do not have to be used to secure pins in place as is the case with shear bolts. Rather the leading edge of the pin or nail is simply bent during installation in order to retain it in place. Yet another advantage is that the leading end of shear pins is tapered which makes it easier to insert into the blunt end of a bolt. Still further, the force required to shear pins or nails secured by bending the ends during installation is that the equivalent amount of force is required to shear the pin or nail at either end. As mentioned above, different forces are required to shear a shear bolt at either the nut or bolt end. By requiring an equivalent amount of force, the post member can yield when hit from opposite directions.

In one form of the invention the base and post member may include elongate or oval holes along at least one side thereof. The elongate holes allow shear pins having a deformed or squashed center section to be inserted. After impact and the non impact sides of the shear pins have been bent, it will not be possible to turn the pins to remove the post. This may prevent unwanted removal of posts and further provides an additional safety feature with regards to the post member becoming disconnected from the base during a collision.

Figure 35 shows a further yielding post assembly 250 of the invention. This assembly 250 has a base 201 and a rubber post 251. The rubber post 251 is secured in place on the base by a spacer block 252.

Figure 36 illustrates a still further yielding post assembly 260 of the invention. The assembly is similar to that of Figure 33 and the same reference numerals have been used to indicate like features. In this assembly, the post member and base are connected by two shear pins 265

which extend through holes in the base and shear member. The pins are secured in place by simply bending the ends.

The side walls 262 of bracket 230 are provided with longitudinal ridges (also seen in Figure 38 which shows a front view of the bracket.) The ridges resist the downward movement of the post member with respect to the base. This restrain prevents the non impact side of the pins from shearing, if the post is loaded in such a way as to force the same side of the post downwards. This type of loading has been found to happen if the post is subjected to static forces of enough magnitude to fail the pins.

Figure 37 shows a further variation of side wall 262 of bracket 230. The corners 264 are rounded to allow the post to fail from side impact.

Figure 39 shows a further variation of a base 270 for use with the yielding post assembly of the present invention. This base 270 is to allow a post member to be mounted to an existing support surface such as concrete or the like. The base has a lower flat section 271 which in use is placed on the surface. Holes 272 are provided to receive screws, nails or the like for securing the base 270 to the surface.

In all the previous examples operation of the yielding post assembly has been explained with the guidepost oriented as shown in Figure 29 to receive a blow from force Ft in the direction of arrow 224. However, the assembly will also operate upon receiving a force Fv along a direction 300 as shown in Figure 29. In this second scenario, bolts 220B and 220C shear while bolt 220A remains intact and acts as a hinge or post retaining means to prevent post member 202 from flying as a projectile. In relation to the assembly of Figures 36 to 38, the shear pin closest to the side of impact shears and the reaming pin remains in place to act as a hinge upon which the post member 203 can pivot.

Figures 40 a, 40b and 40c illustrates a roadside guidepost assembly 200 when subjected to either front or side impact. Figure 40a shows the assembly in place on the roadside. The assembly is similar to that of Figure 36 in that the base 201 of the assembly is attached to post member 203 by two shear pins 265. Suitably, the base is connected to an anchor as

described in previous embodiments, although the anchor is not shown.

When the post 202 is subjected to an impact along the direction of arrow B the shear pins 265 shear at the ends closest to the point of impact. The other ends of the pins bend to allow the post member 202 to yield in a nondestructive manner as shown in Figure 40B. Should the post 203 be hit by a force from the direction along the line B^1 then the other ends of the pins will shear and the post will yield in the opposite direction.

Should the post be struck with a force along line C, the pins closes to the point of impact will shear and the reaming pin will remain intact such that the post can yield as shown in Figure 40C. If the post is struck along the direction of arrow C^1, the post will yield in the opposite direction.

It can be seen that a yielding post of the present invention can yield in a non-destructive manner when hit from any of four sides. Further, the post remains attached to the base so as not to form a projectile.

It can be seen that the earth-anchoring member of an embodiment of the present invention has a much improved hold down capabilities as compared to conventional posts and in particular posts formed from lengths of hollow pipe. By providing a superior hold down capability the posts may not require being placed in a hole which be then filled with concrete. Still further, the anchor of the present invention can be driven directly into the soil without requiring a hole to be dug first. Driving of the earth anchor can be facilitated by use of an adapter or driving dolly according to a further form of the invention.

It can also be seen that the stabilizing collar of the present invention when used with either conventional posts, or anchors of the present invention can offer protection to the post or anchor by increasing the effective post cross section with respect to surrounding soil so as to restrain lateral movement of the post or anchor and to reduce the stress concentrations experienced by a post or anchor at ground level. Still further when the collar includes an upstanding sleeve, the sleeve can protect that part of the post or anchor immediately above the ground surface from the effects of moisture, termite attack and the like.

It can also be seen that the yielding post assembly of the present invention can yield in a non-destructive manner when hit from any of four sides. Further the post remains in contact with the base so as not to form a projectile.

Further, a yielding post assembly of the present invention which includes an anchor of the present invention and further a stabilizing collar of the invention can be installed in a ground surface without the need for digging a hole and filling the hole with concrete. Installation can therefore be achieved in a cost-effective manner. Further, the post can yield in a non-destructive manner upon impact. In order to reassemble the post all that is required is for the damaged shear pins to be replaced. This offers a significant advantage over existing wooden guide posts which must be completely replaced when damaged. This is a labor intensive and expensive process, together with being a waste of a resource such as timber.

It will be appreciated that various changes and modifications may be made to the invention as described and claimed herein without departing from the spirit and scope thereof.

CLAIMS:

1. An earth anchoring member having an upper body portion and a lower ground engaging portion having opposed side faces, a flattened insert end with a leading edge, a raised portion extending from each said face, each raised portion tapering towards and terminating at the insert end and two opposed ground retaining flanges which extend outwardly from the upper body portion and terminate at the leading edge.

2. The member of claim 1, wherein the upper body portion is of a constant cross section and the leading edge is wider than the maximum width of the upper body portion.

3. The member of claim 1, wherein the upper body portion has connecting means for connecting a post member.

4. A post assembly operative to yield during impact, the assembly including an earth anchoring member of claim 3 and a post member connectable therewith, wherein the connecting means includes collision release means and post member retaining means, whereby upon impact the collision release means fails so that in use the post member can yield in response to the impact and the post retaining means retains connection with the post member.

5. The member of claim 4, wherein the connecting means includes at least two members, and during impact at least one member or a part thereof fails so as to release the post member and at least one member or a part thereof retains the post member in contact with the earth anchoring member.

6. An earth anchor assembly, the assembly including the earth anchoring member of claim 1 and a stabilizing collar which in use is located below a ground surface, the collar having an upper section, an aperture in the upper section through which the anchoring member may pass and be held, and an outwardly curved stabilizing surface depending from the upper section.

7. A method of driving the member of claim 1 into a ground surface, the method including providing an adapter having a lower section which in use abuts the upper body of the member and an upper section sized to receive the operative end of a power tool, mounting the adapter to the member and

activating the power tool so as to drive the member into the ground surface.

8. A stabilizing collar for a ground engaging member, the collar having an upper section, an aperture in the upper section through which the member can pass and be held, and an outwardly curved stabilizing surface depending from the upper section.

9. The collar of claim 8 having an upstanding sleeve which in use surrounds the ground engaging ember and projects above the ground surface.

10. A post assembly operative to yield during impact, the assembly including a base, a post member, connecting means for connecting the base to the post member, the connecting means including collision release means and post member retaining means, whereby upon impact, the collision release means fails so that in use the post member can yield in response to impact and the post retaining means retains connection with the post member.

11. The assembly of claim 10, wherein the connecting means includes at least two members, and during impact at least one member or a part thereof fails so as to release the post member and at least one member or a part thereof retains the post member in contact with the earth anchoring member.

12. The assembly of claim 10, wherein the base includes a ground anchoring member, the member having an upper body portion and a lower ground engaging portion, the ground engaging portion having a leading edge and opposed ground retaining flanges extending at least initially outwardly from the upper body portion.

13. The assembly of claim 10, which includes at least two parallel shear members, each member having a first end and a second end connected by a shaft and when the assembly is struck in a direction substantially parallel to the shaft and adjacent the first ends of the members, the members shear near the first ends so as to release the post member and each shaft bends at a point adjacent the second end and retains connection with the post member.

14. The assembly of claim 13, wherein when the assembly is struck in a

direction substantially normal to the shanks of the members, the member nearest the point of impact fails, and the member furthest from the point of impact remains intact and retains contact with the post member.

15. A ground anchoring member having an upper body portion and a lower ground engaging portion, the ground engaging portion having a leading edge and opposed ground retaining flanges which extend at least initially outwardly from the upper body.

16. A ground anchoring assembly including the ground anchoring member of claim 15 and the stabilizing collar of claim 8.

17. The ground anchoring member of claim 15, which further includes at least one ground engagement member which in use extends from the body of the ground anchoring member.

18. The ground anchoring member of claim 17, wherein the upper body portion is hollow with slots in opposing sides thereof, and two ground engaging members which are movable from a withdrawn position substantially within the body and a ground engaging position in which at least part of each member extends from the body and through the slits therein.

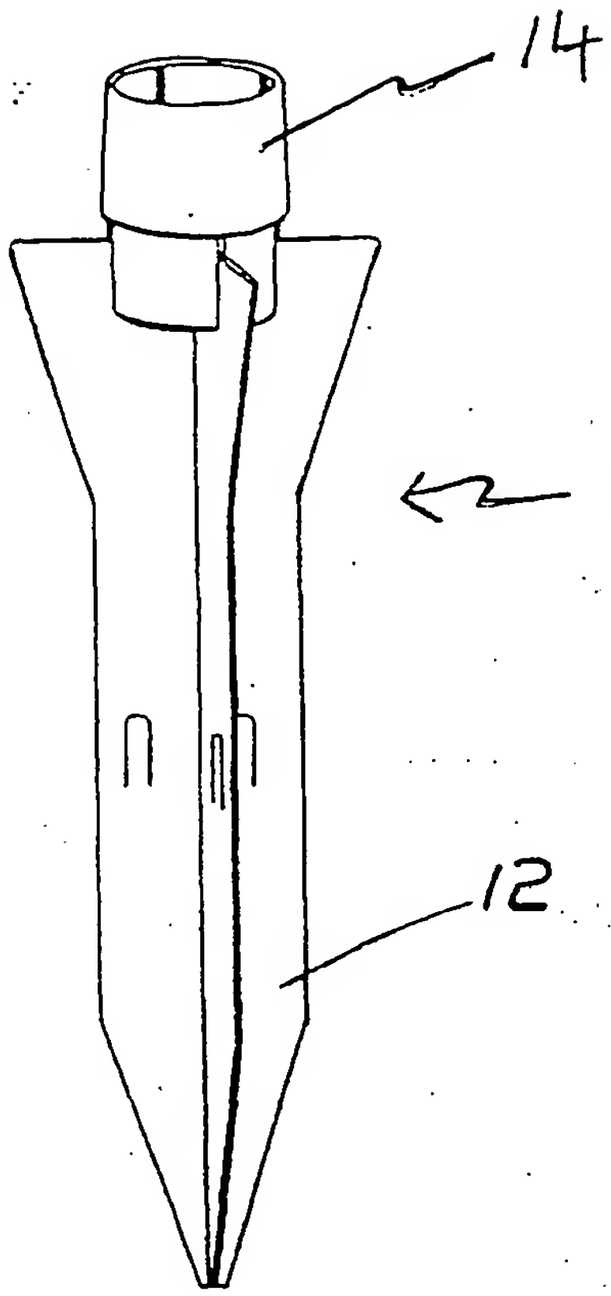


Fig. 1

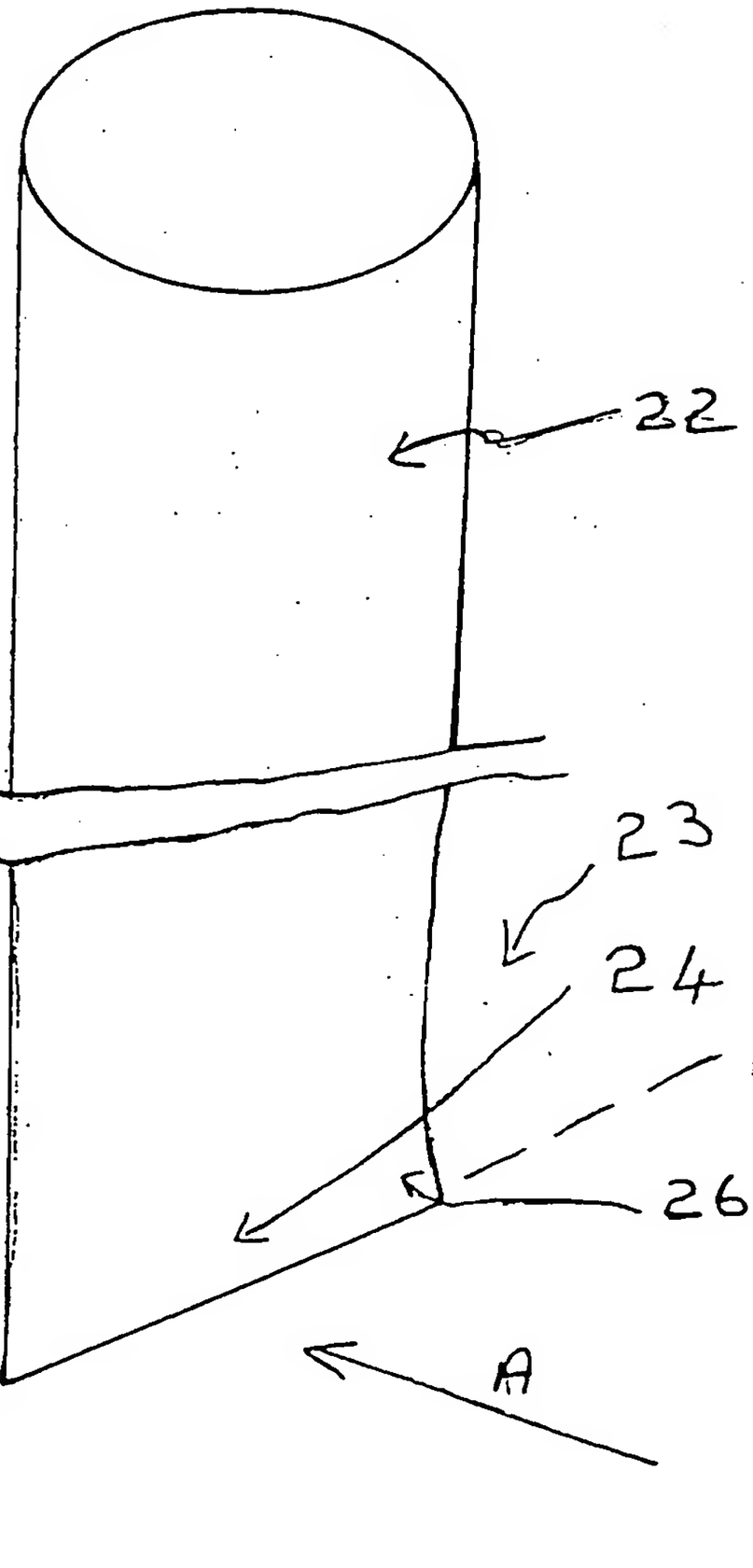


Fig. 2

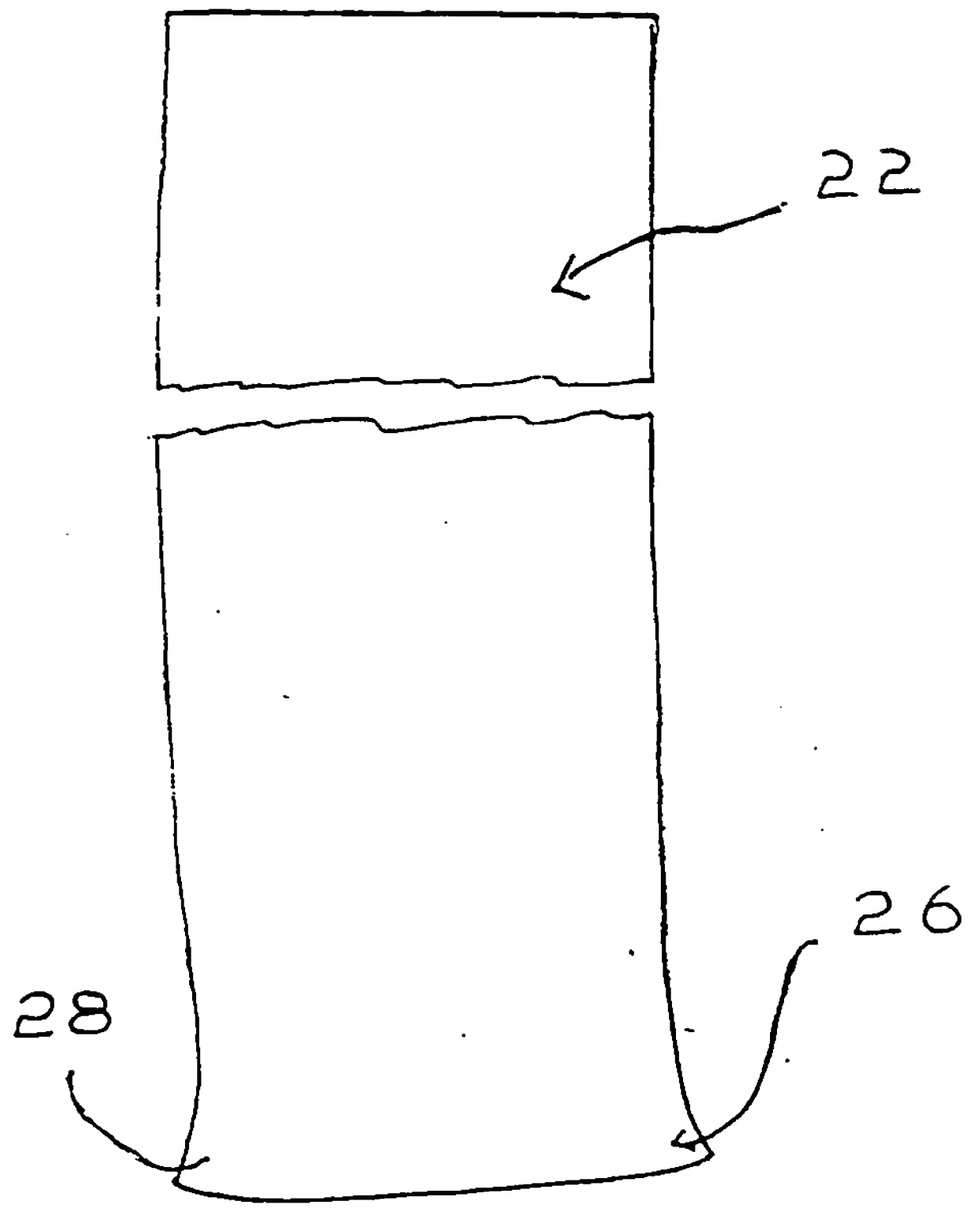


Fig. 3

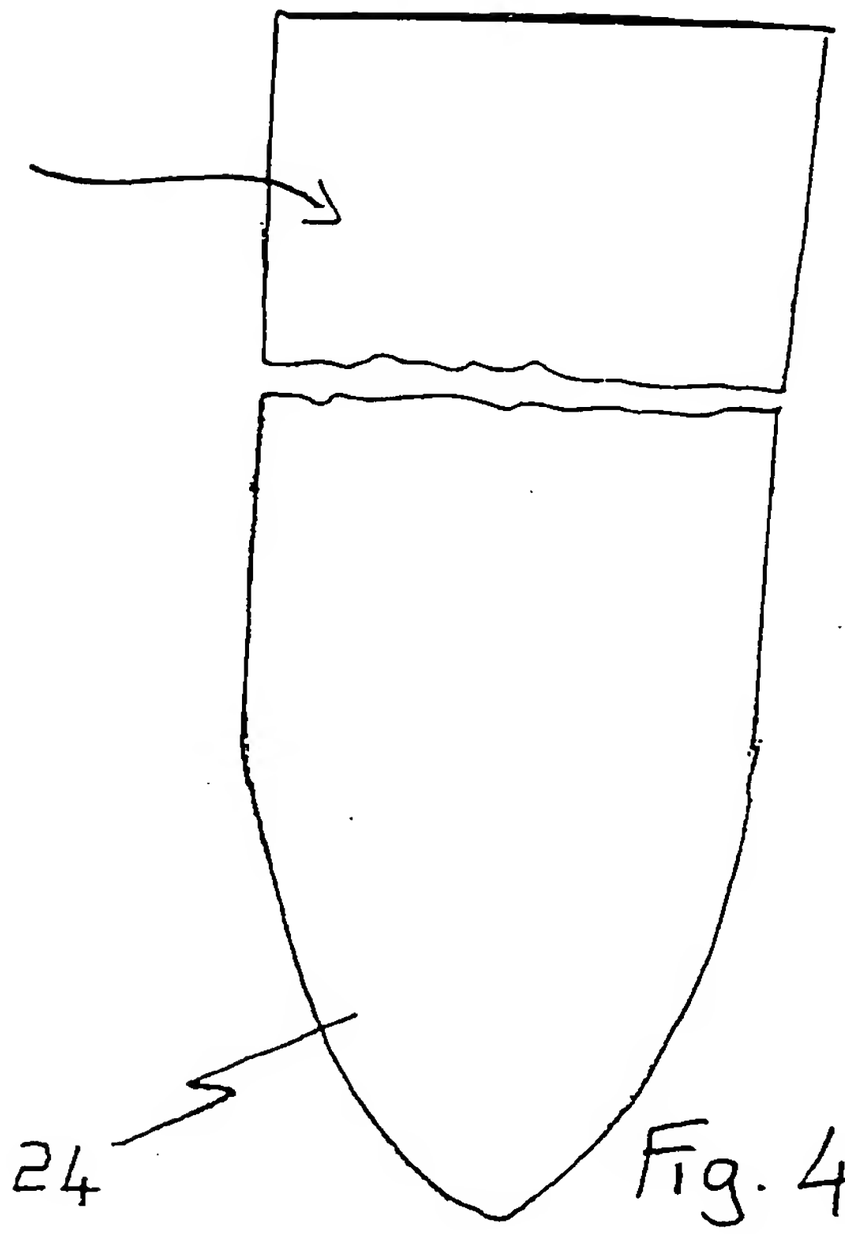


Fig. 4

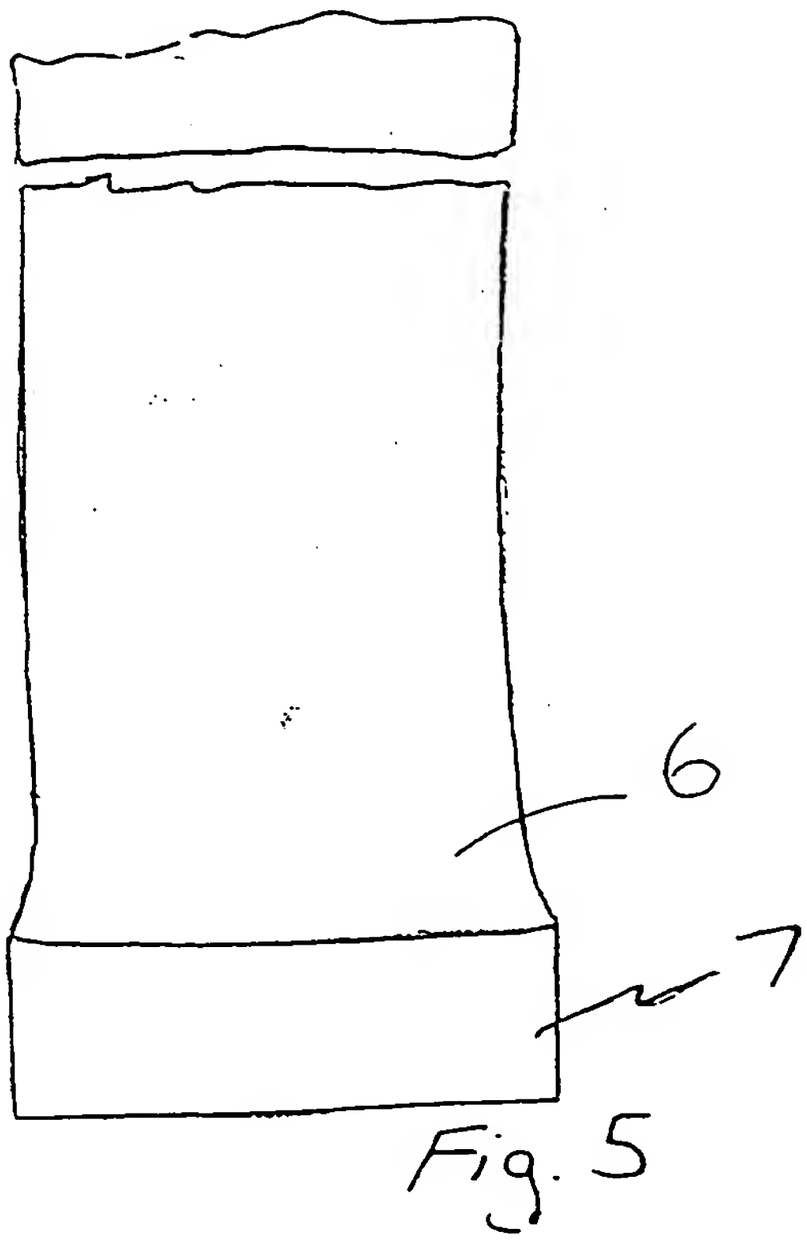


Fig. 5

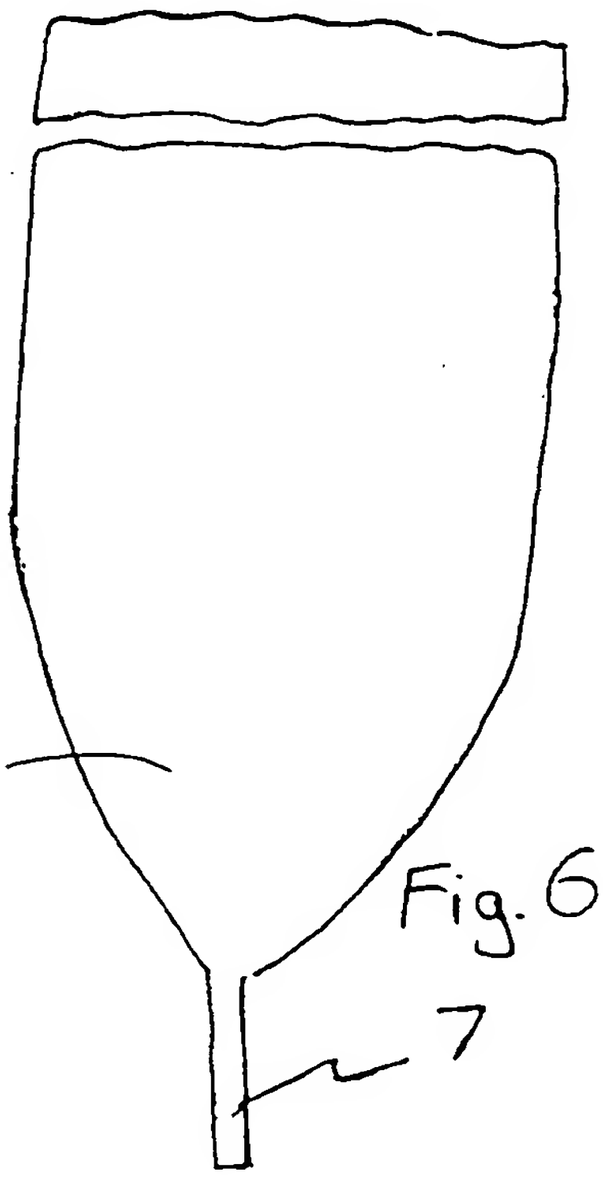


Fig. 6

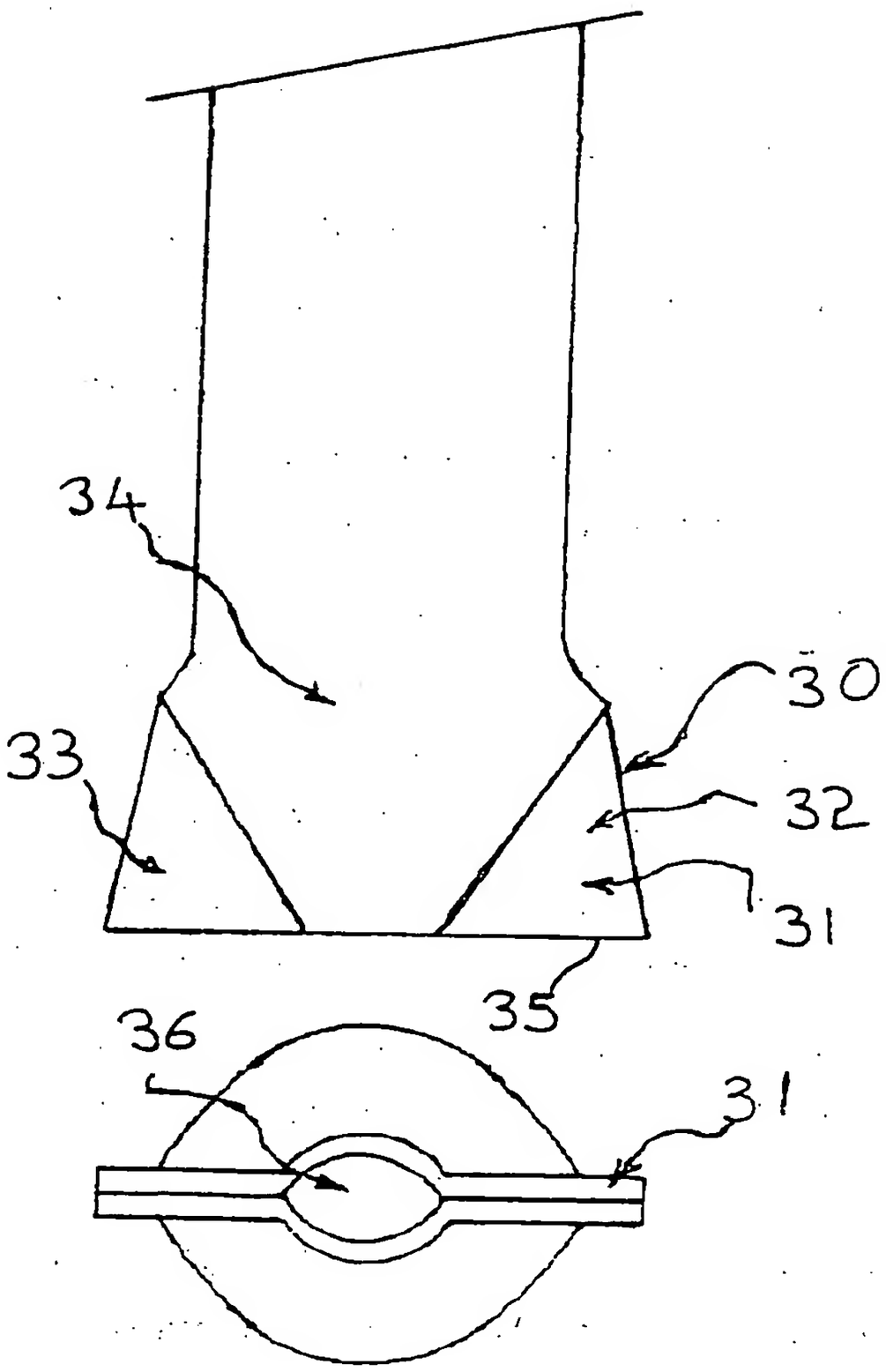


Fig. 7

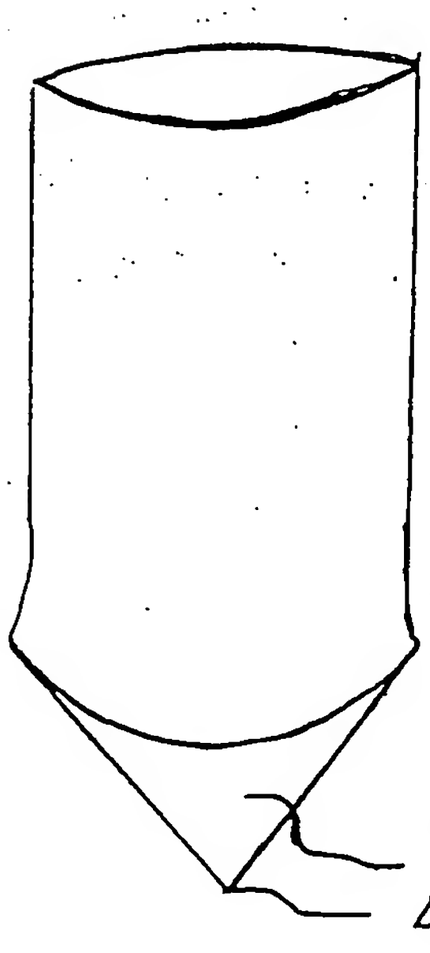


Fig. 8

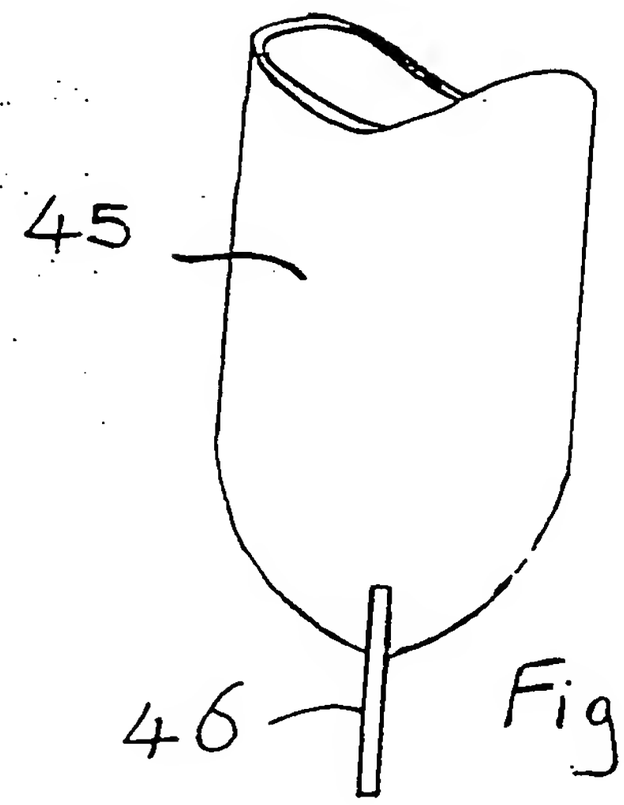
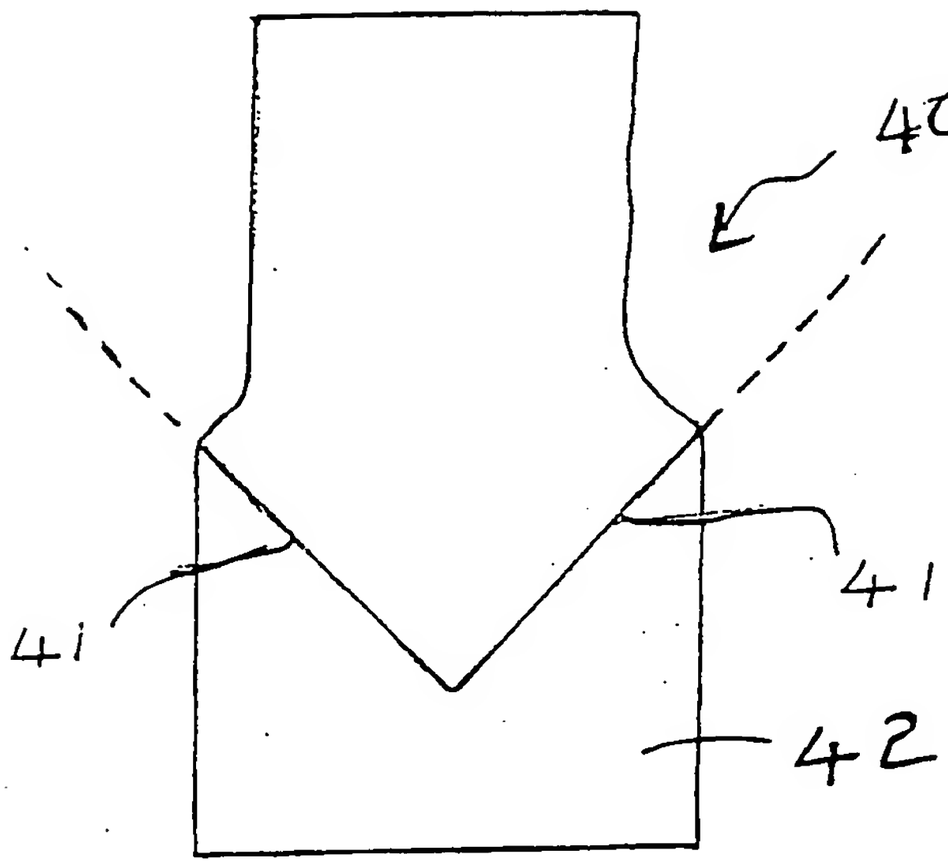


Fig. 9



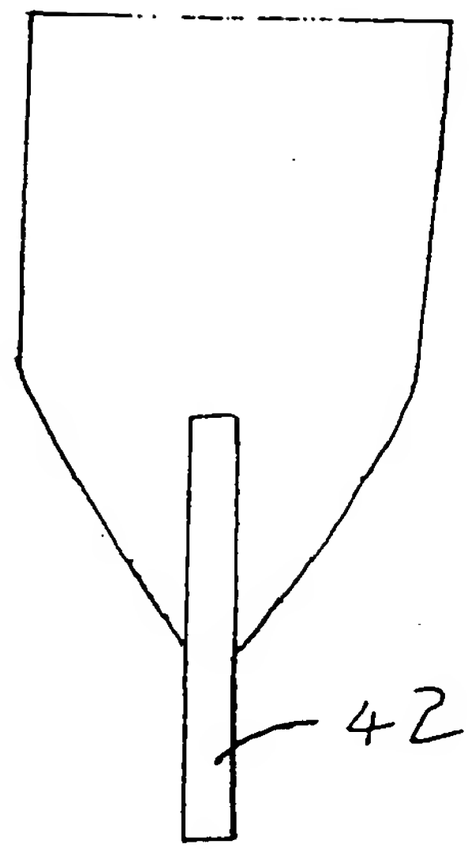


Fig. 11

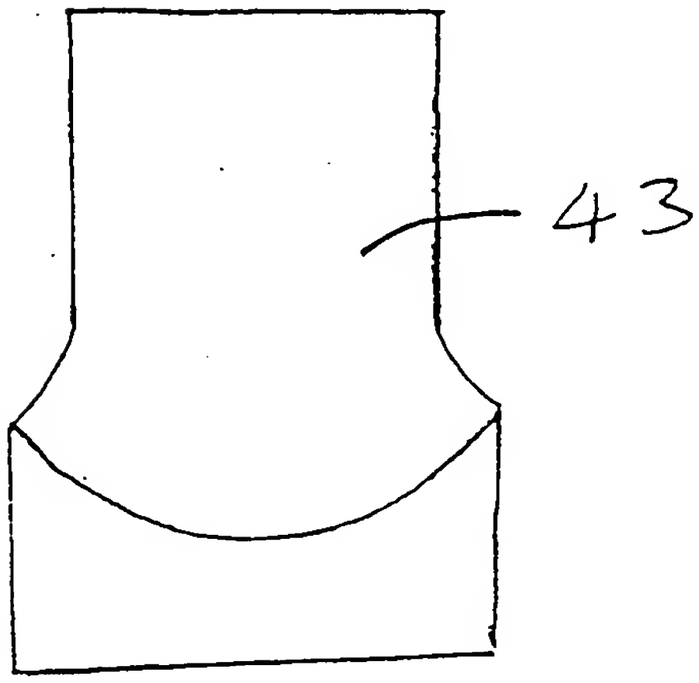


Fig. 12

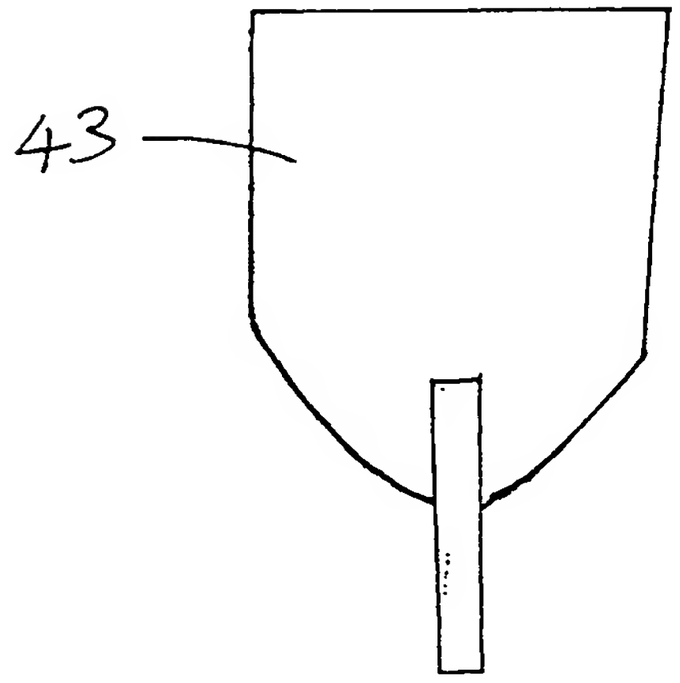


Fig. 13

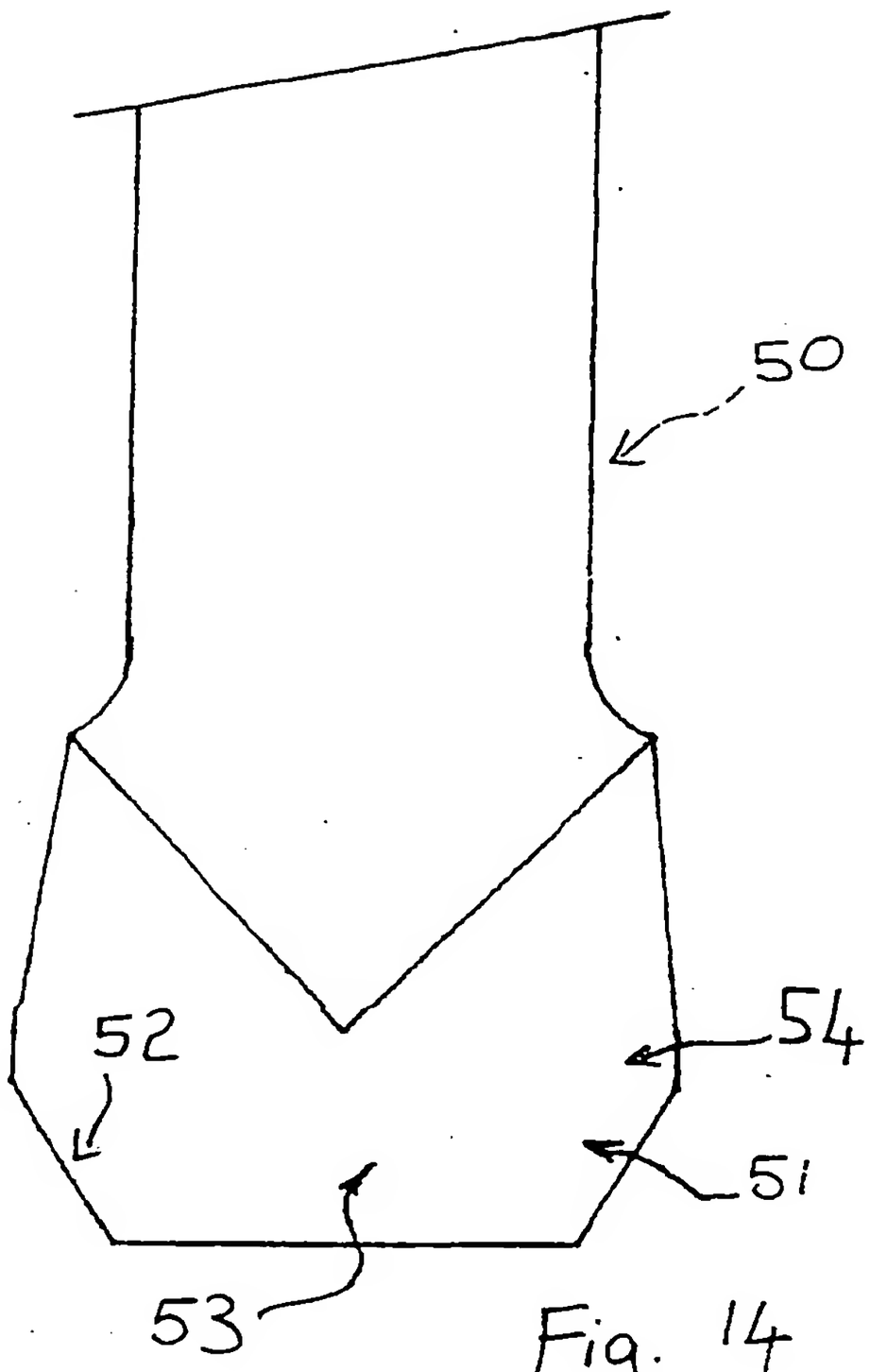


Fig. 14

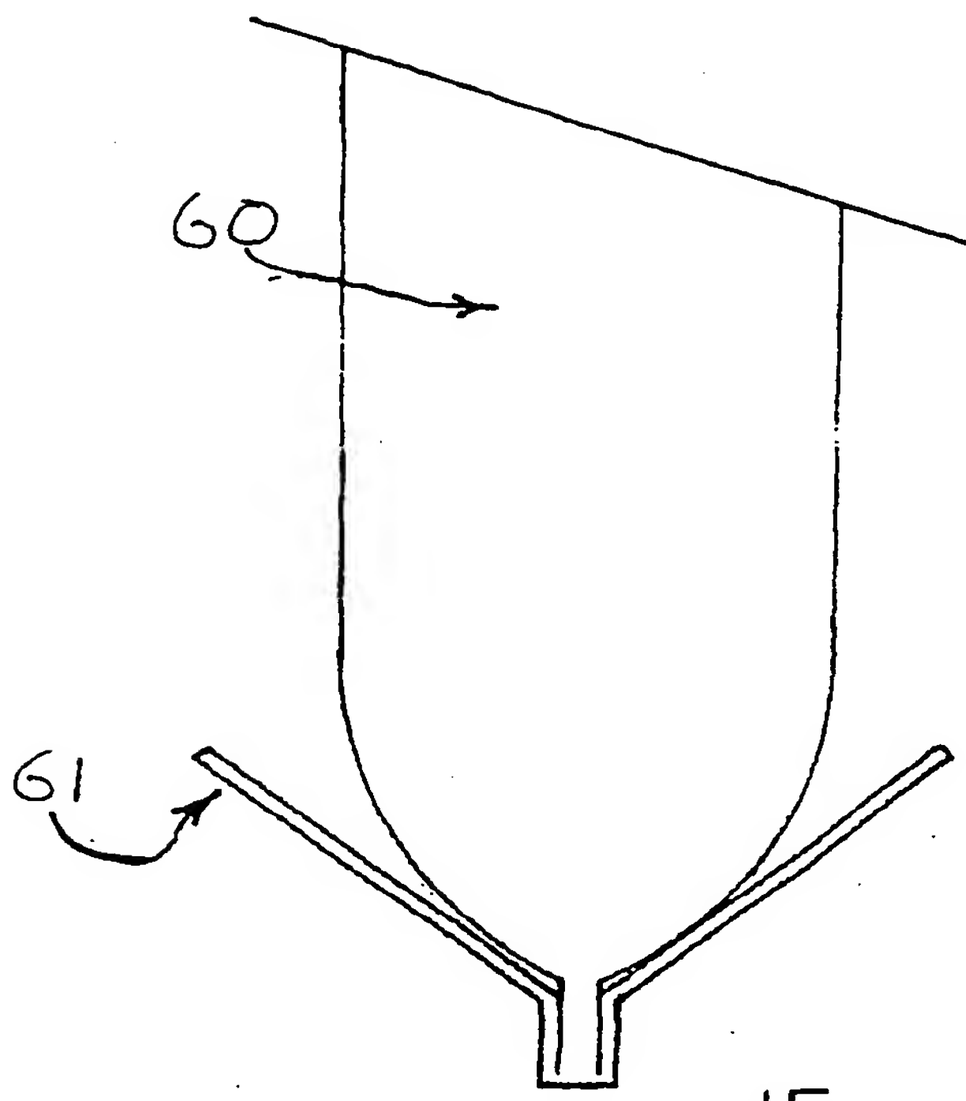


Fig. 15

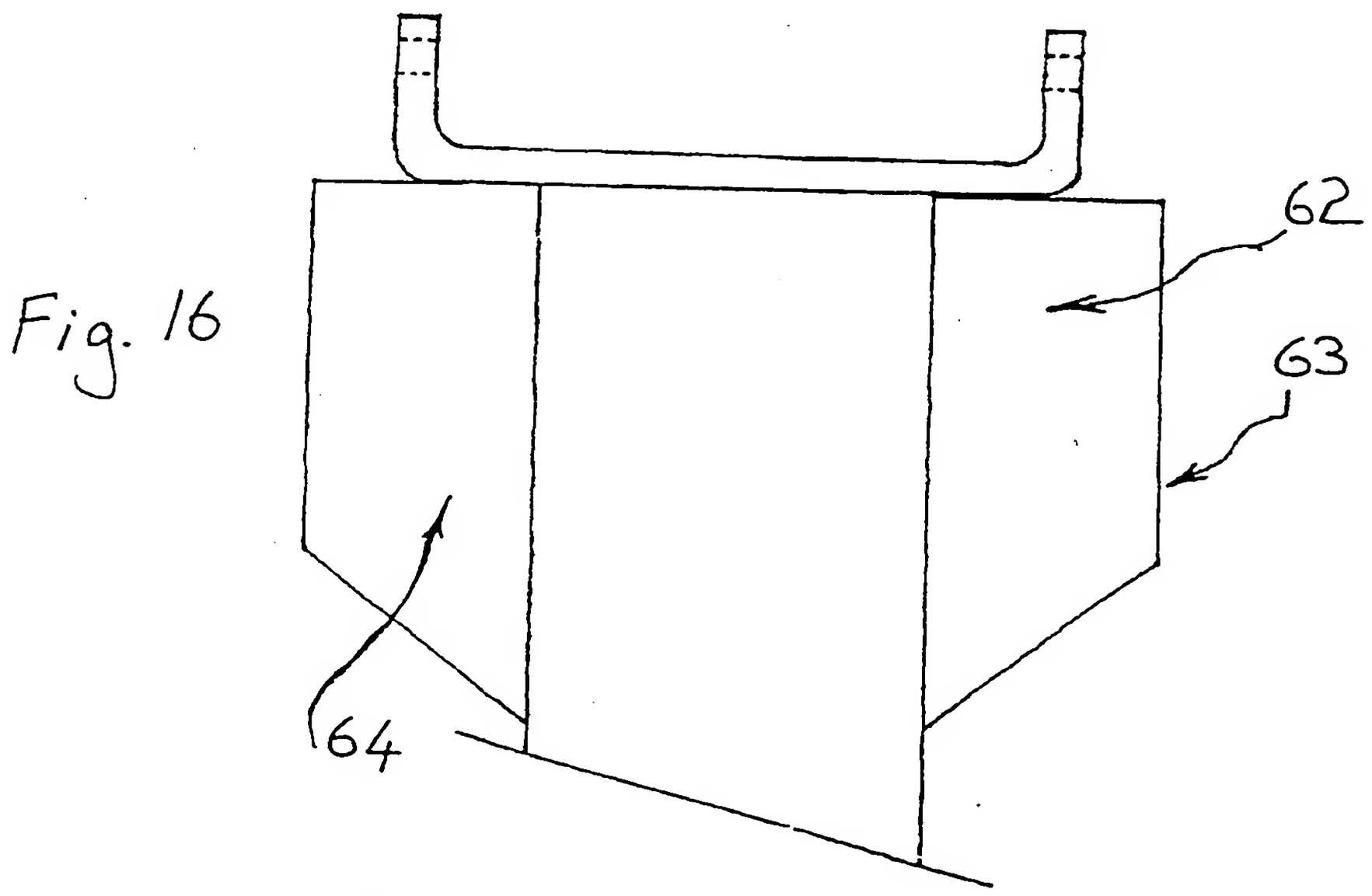


Fig. 16

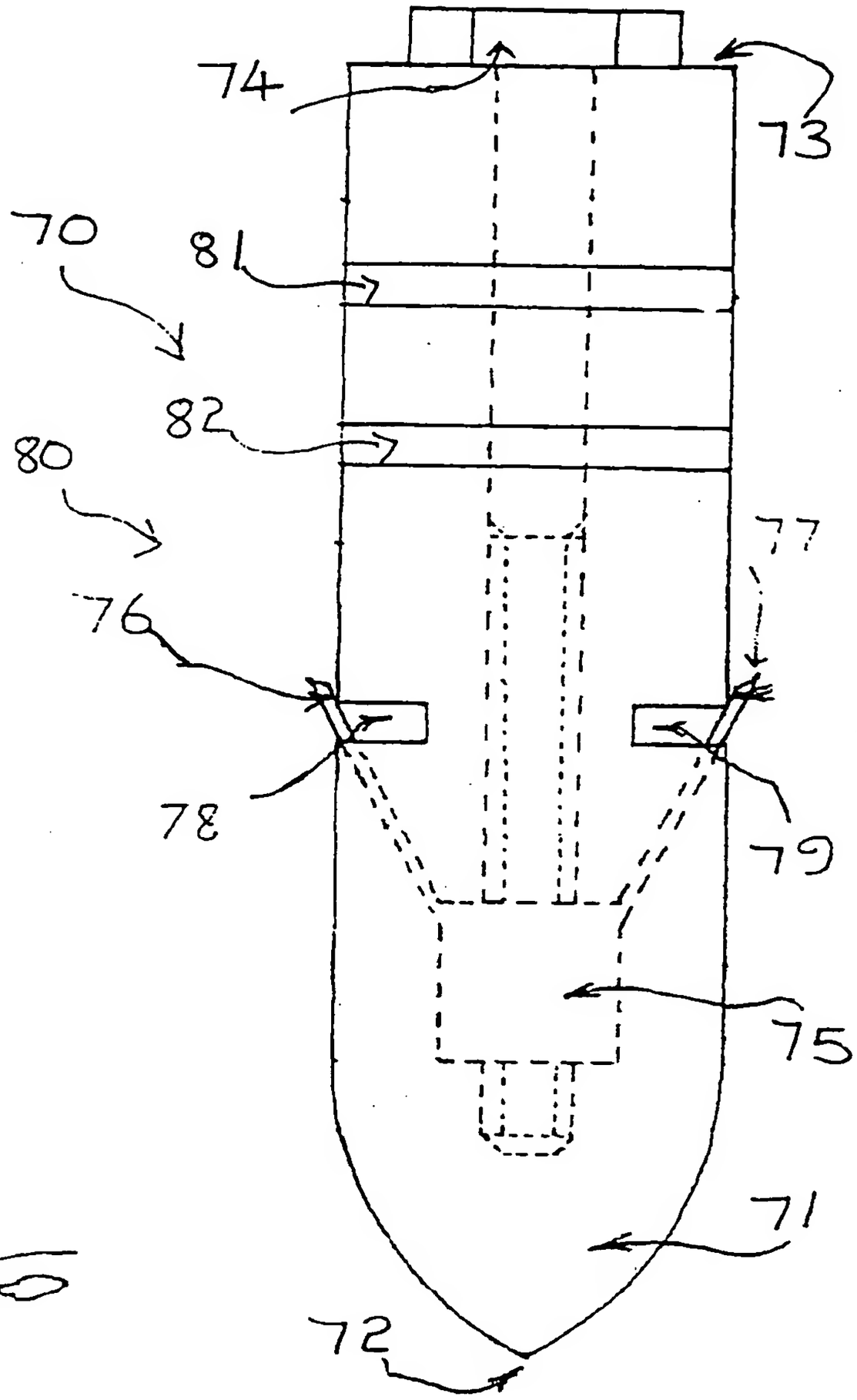


Fig. 17

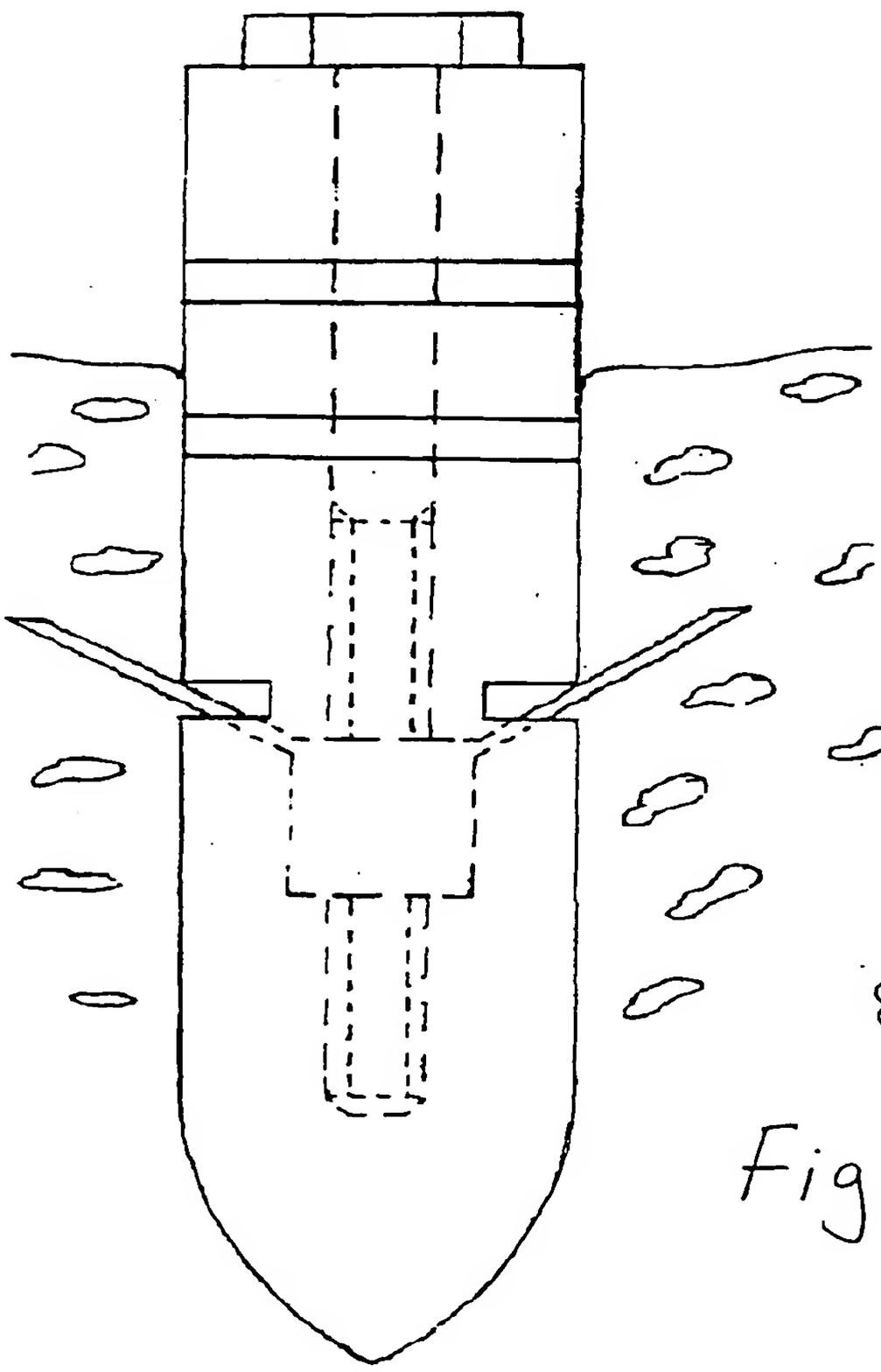


Fig. 18

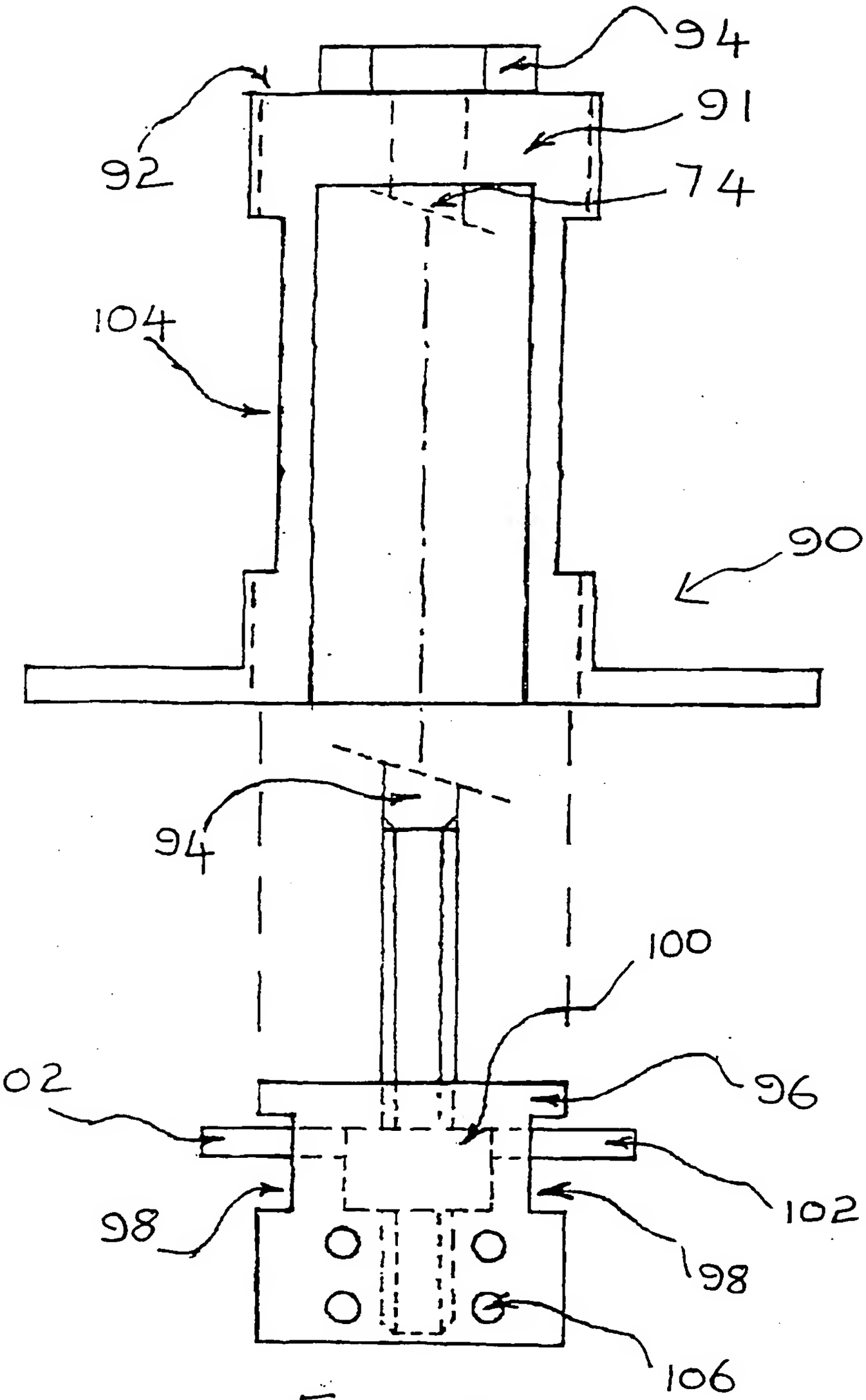


Fig. 19

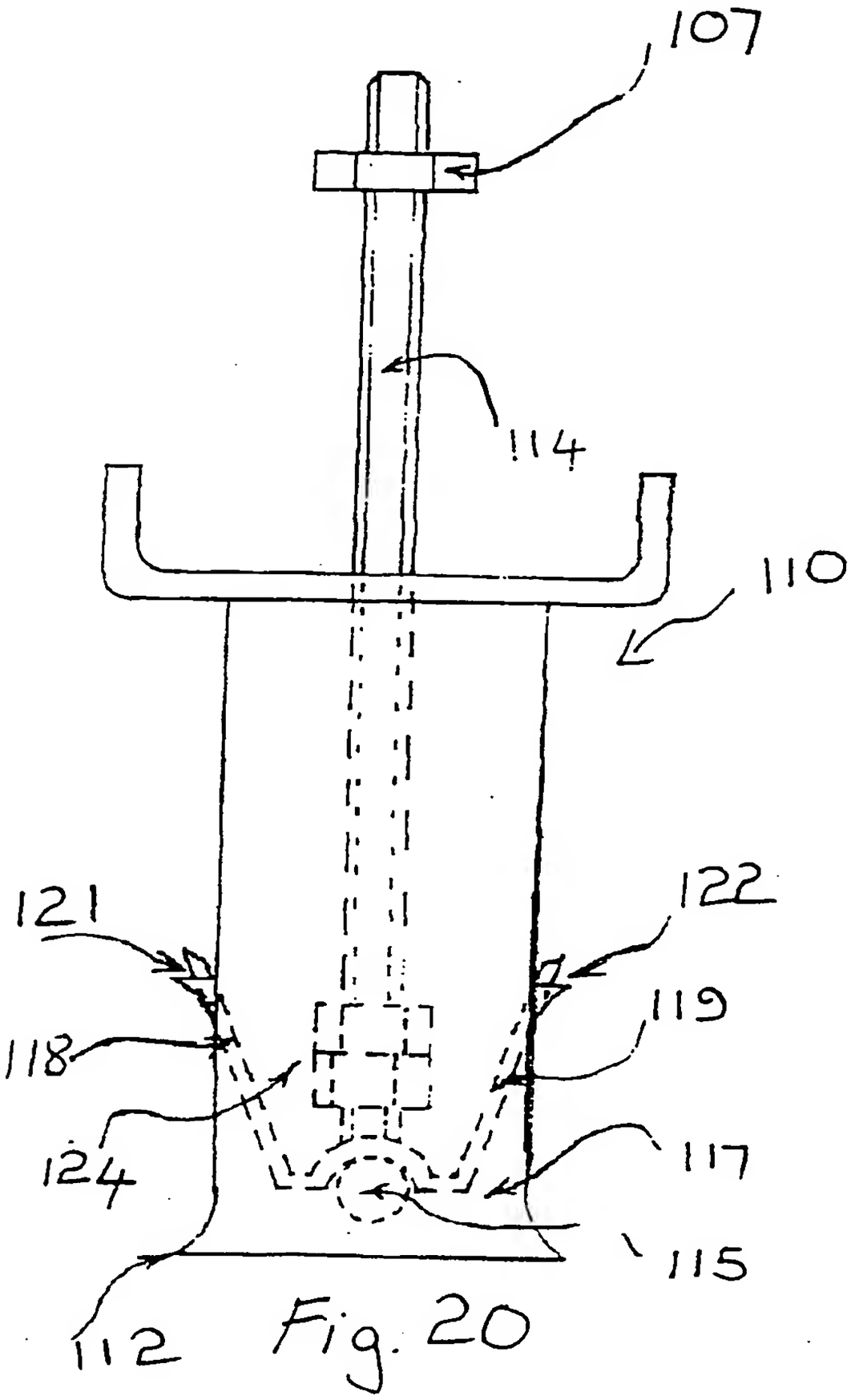


Fig. 20

Fig. 20

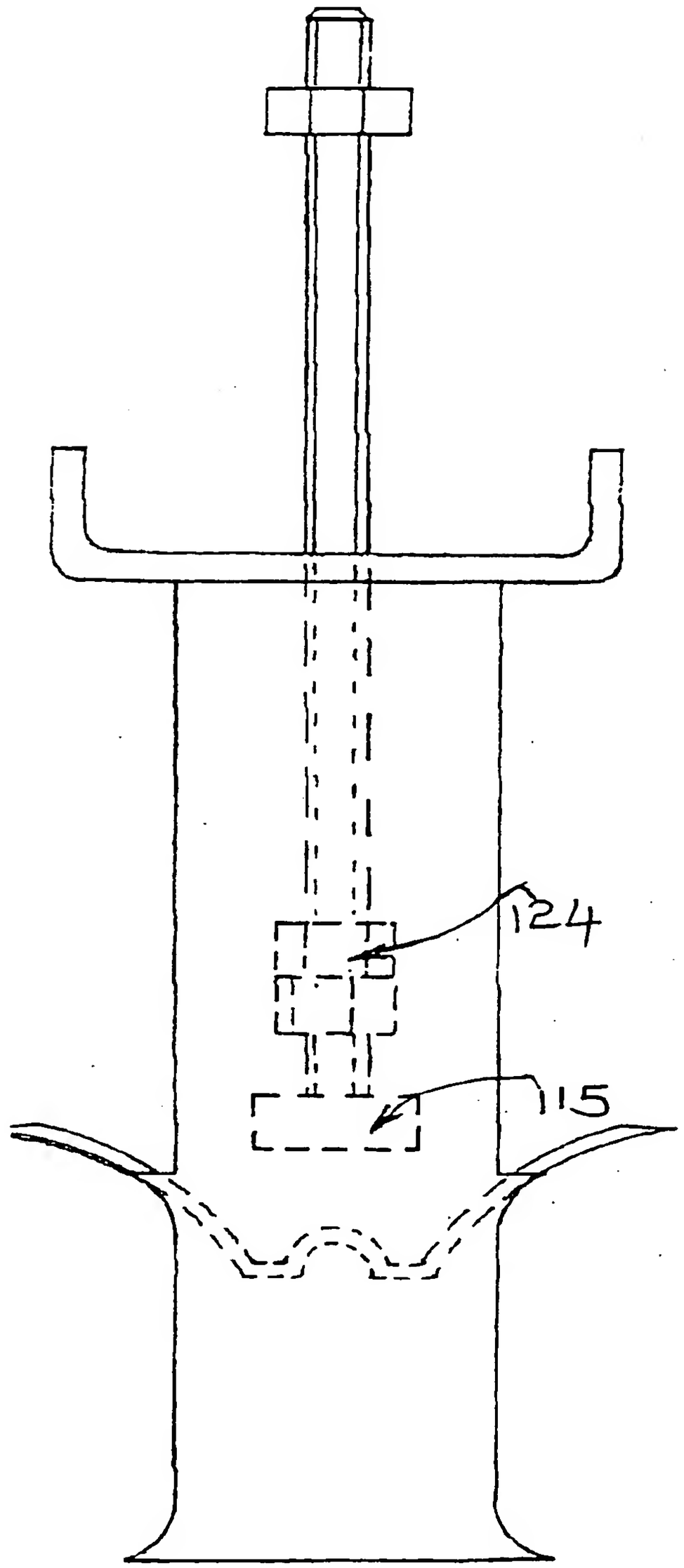


Fig. 21

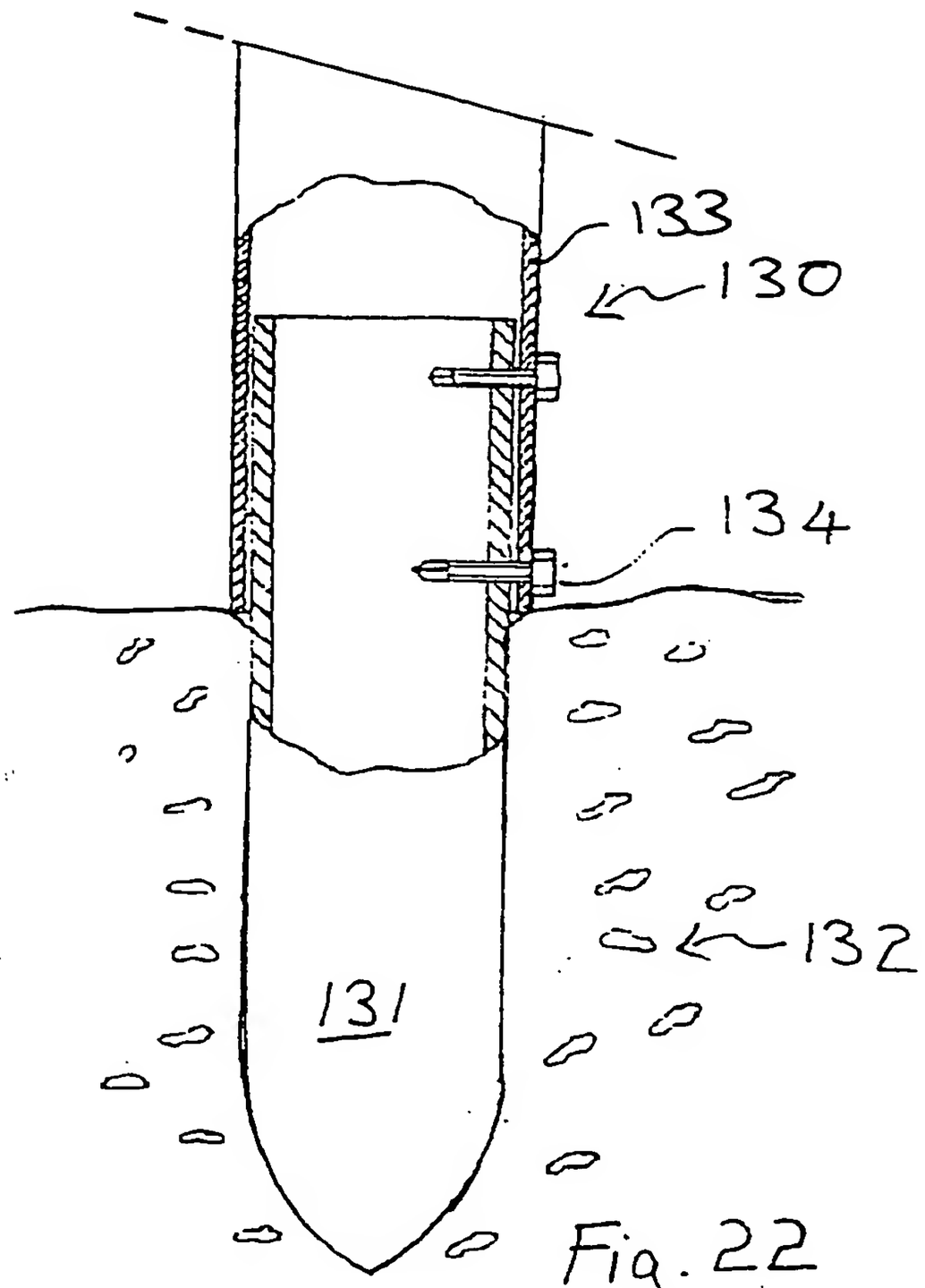


Fig. 22

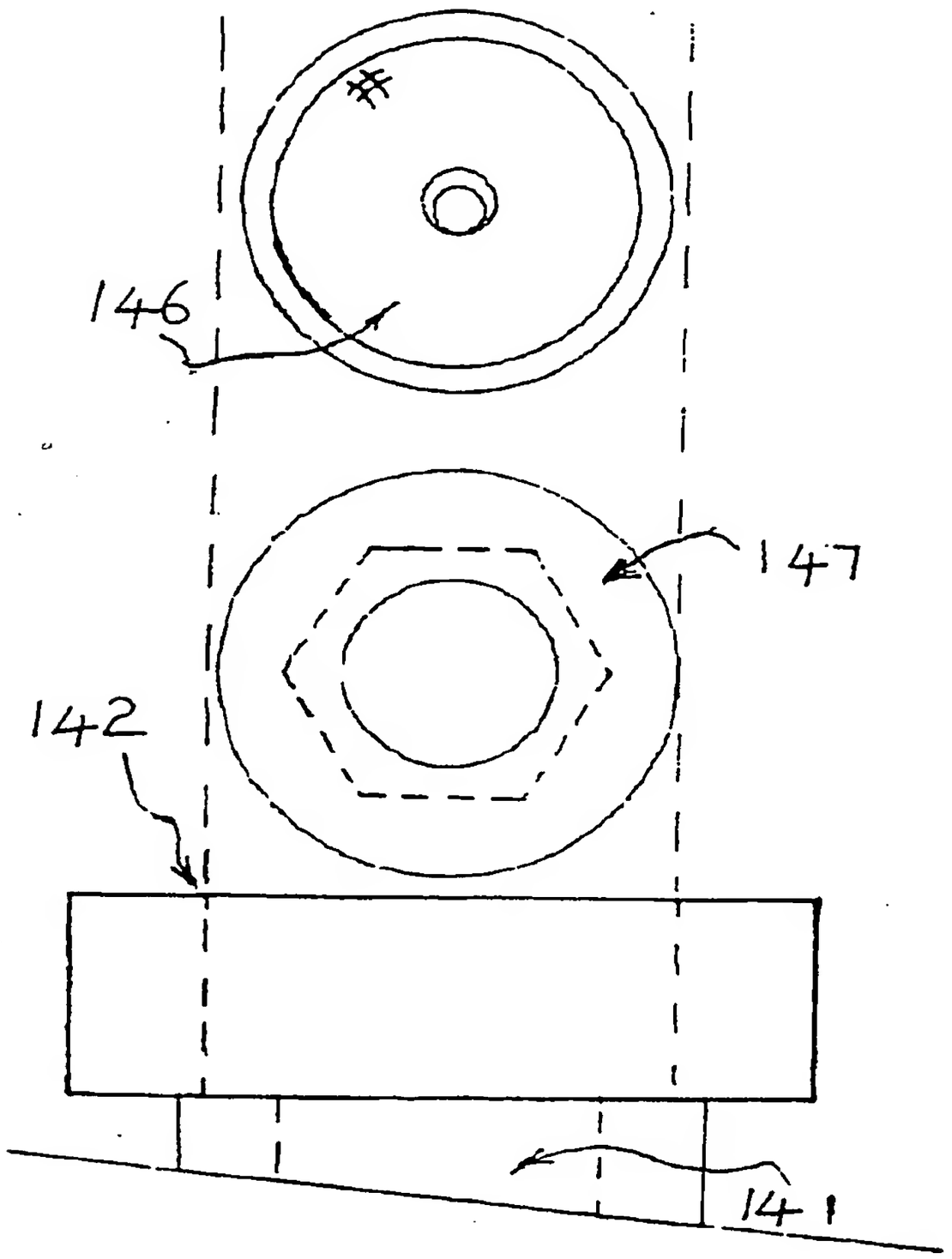


Fig. 24

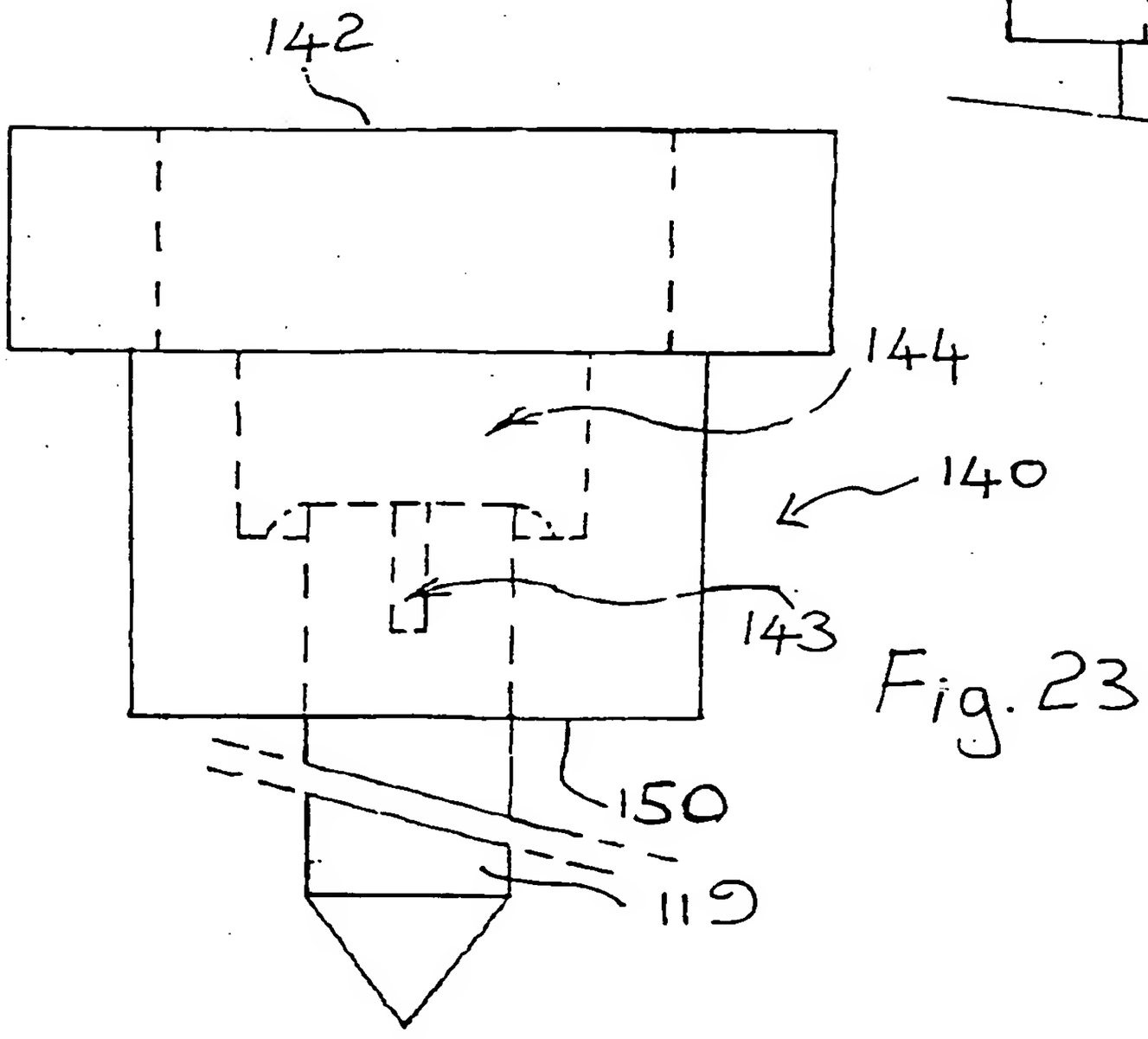


Fig. 23

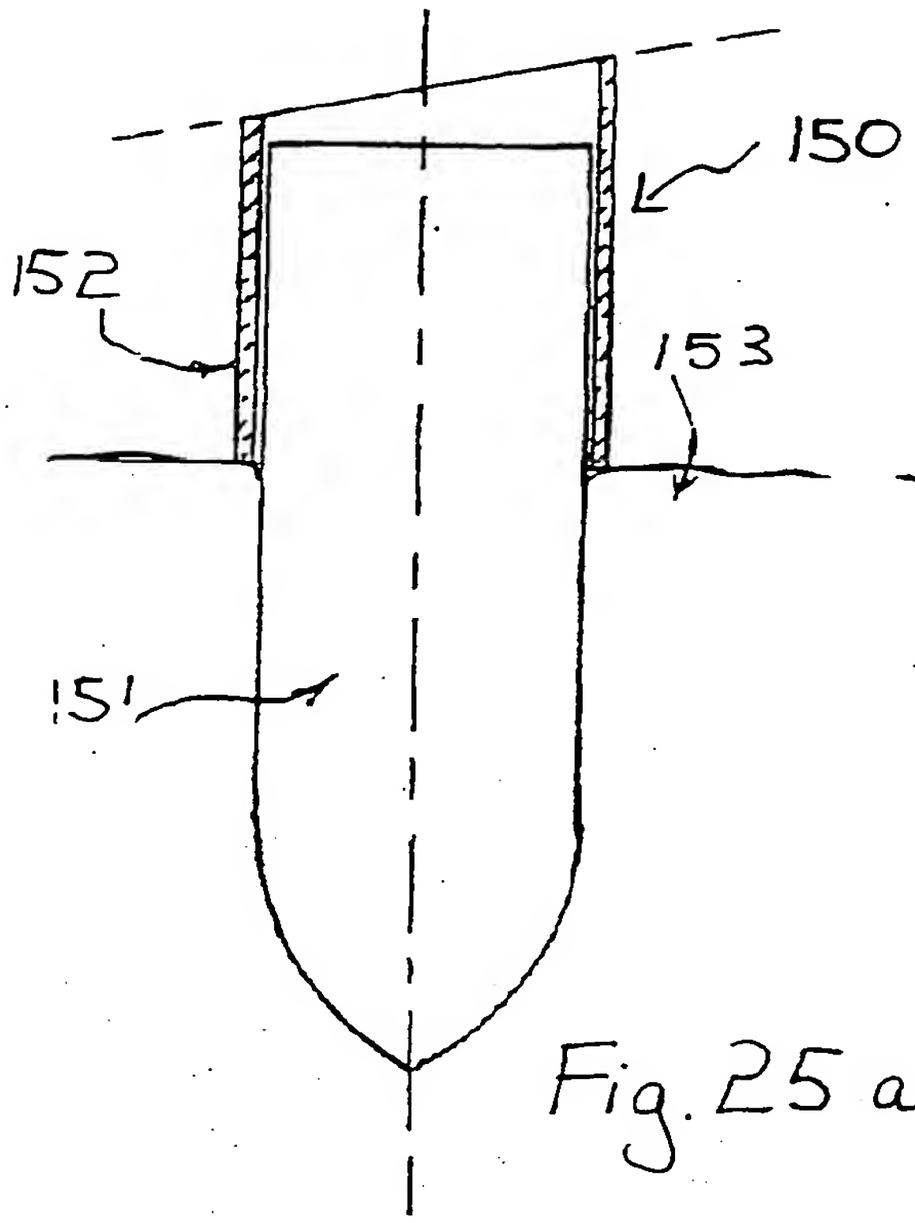


Fig. 25a

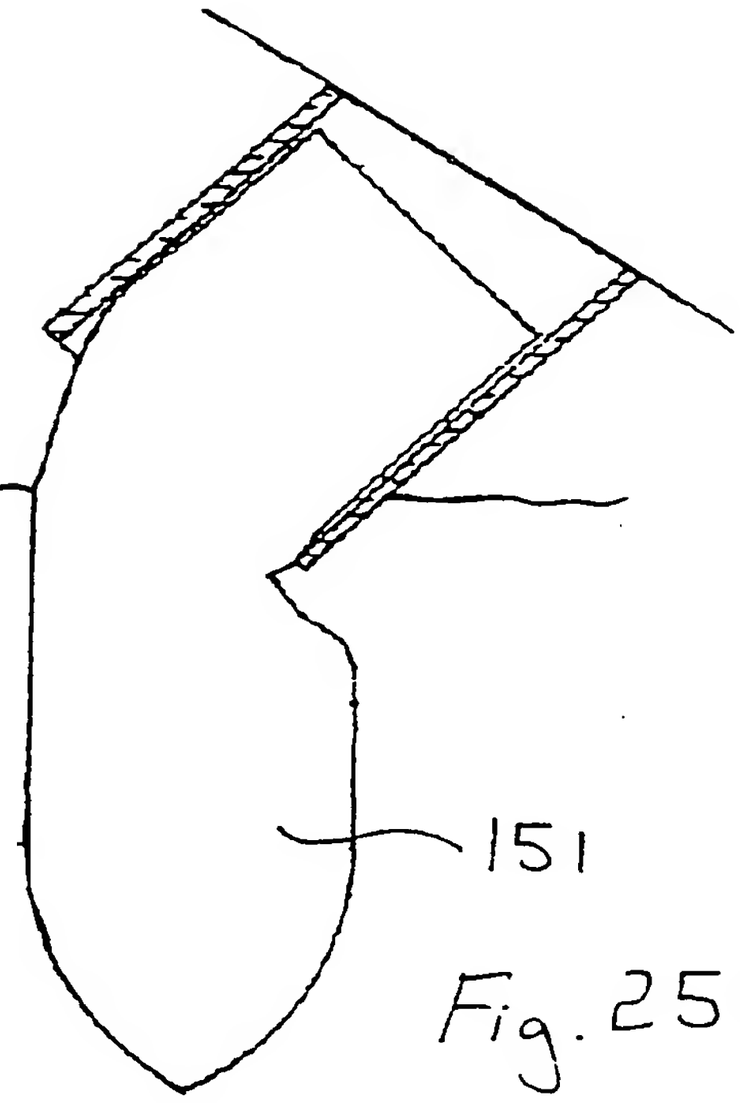


Fig. 25b

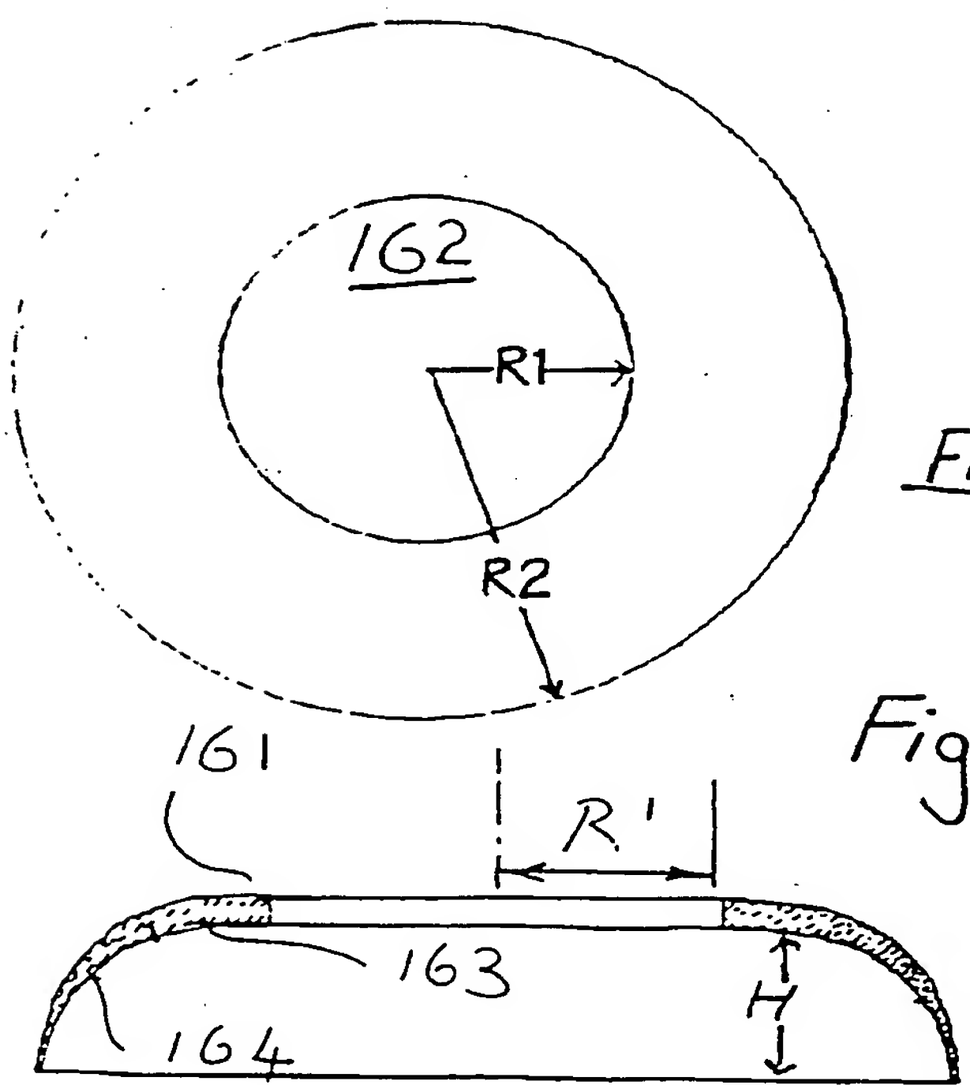


Fig. 27

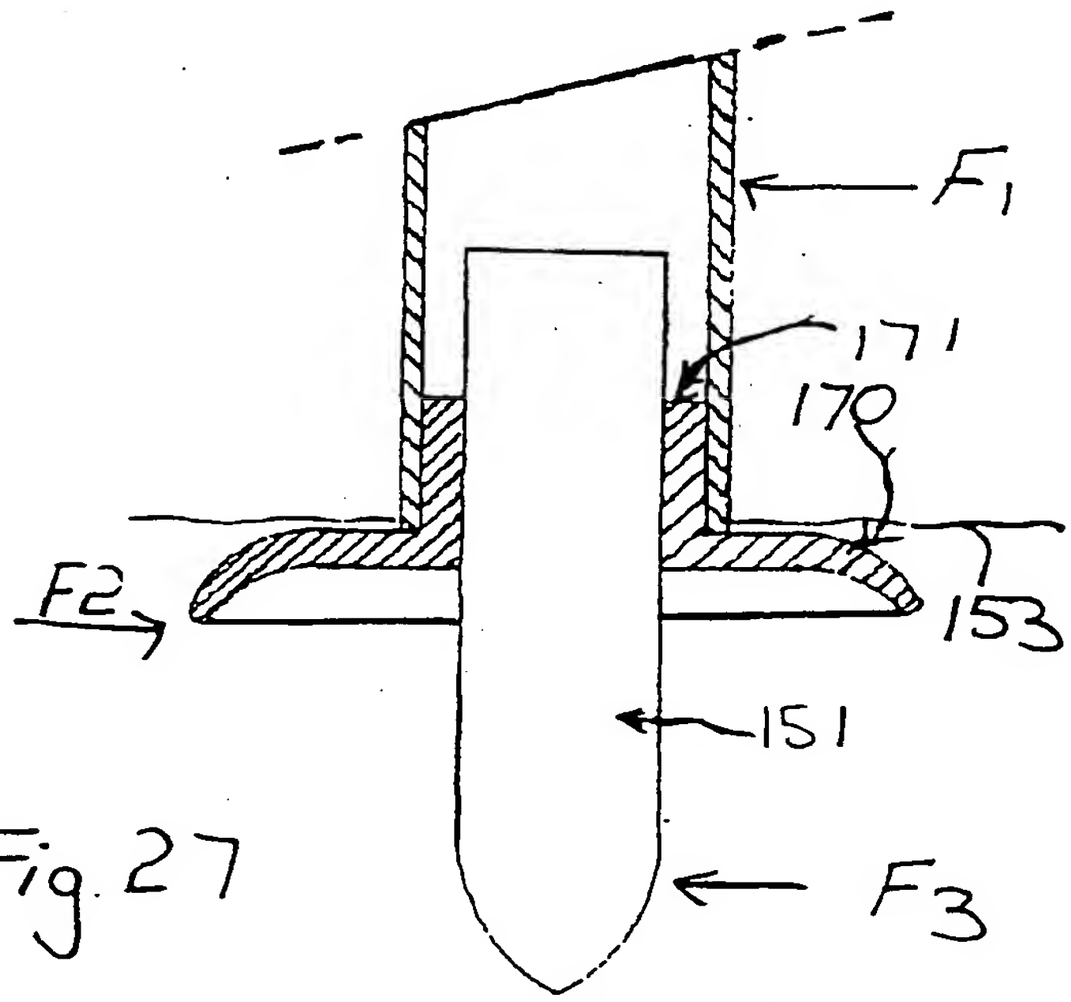


Fig. 28

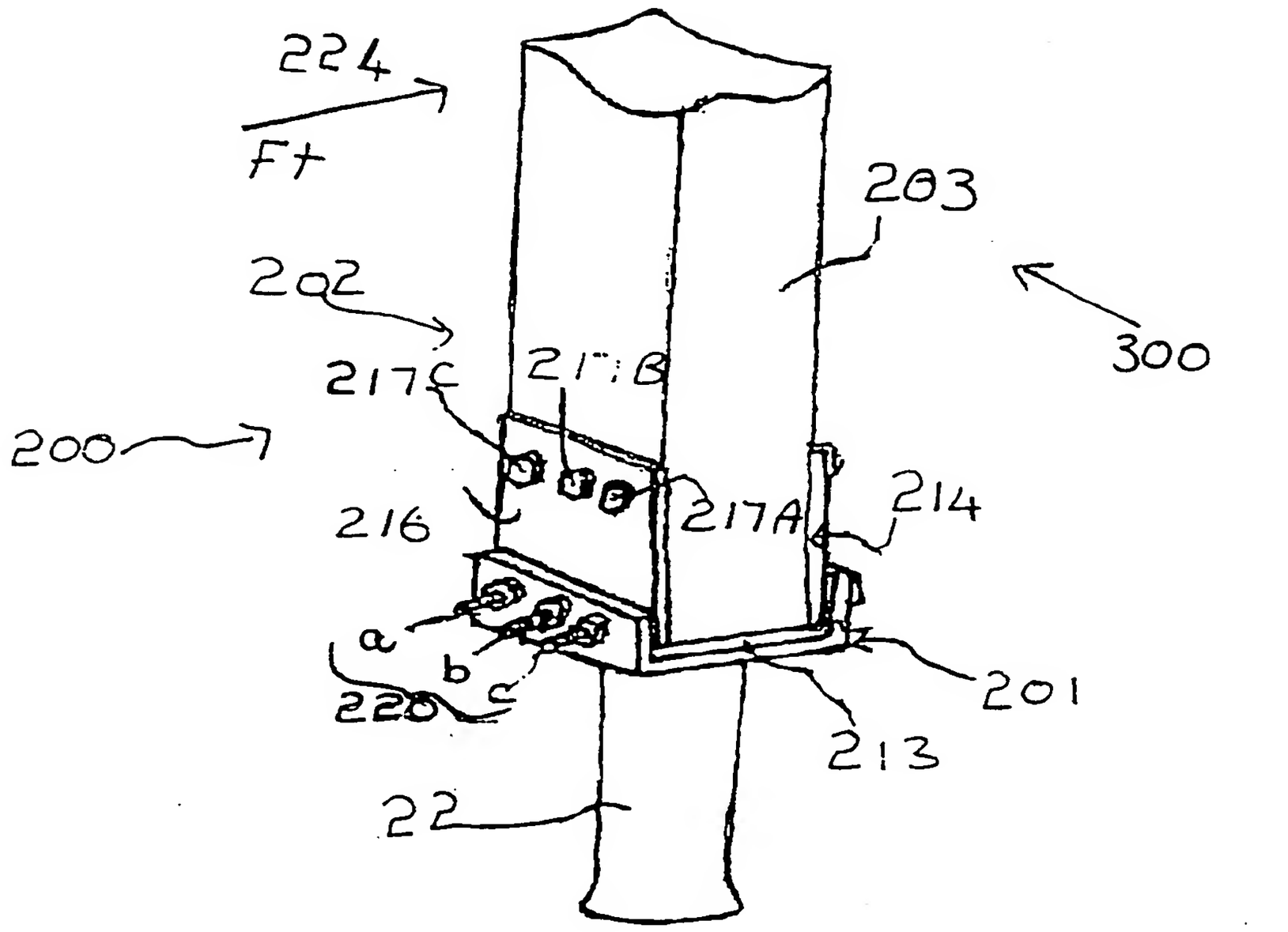


Fig. 29

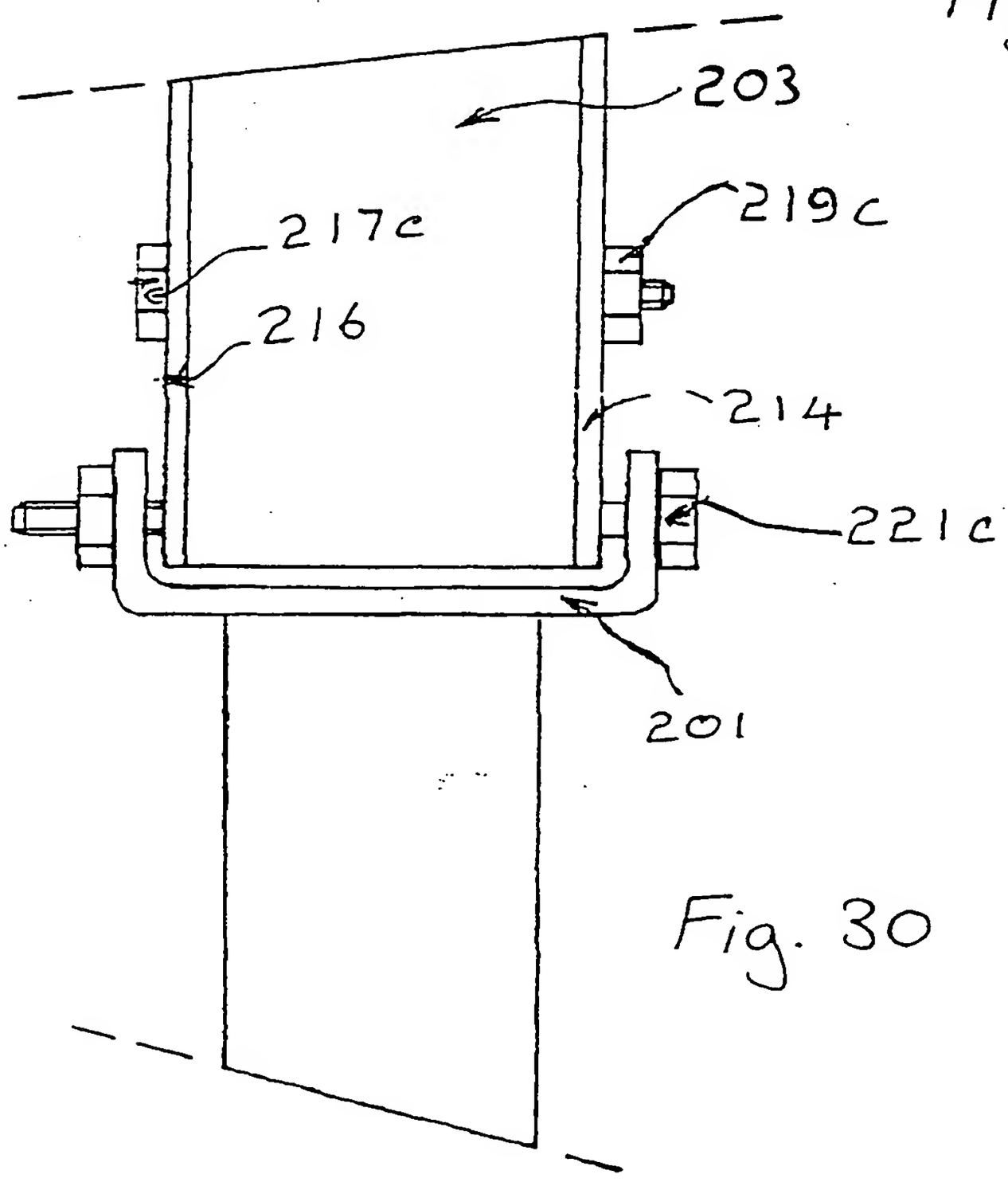


Fig. 30

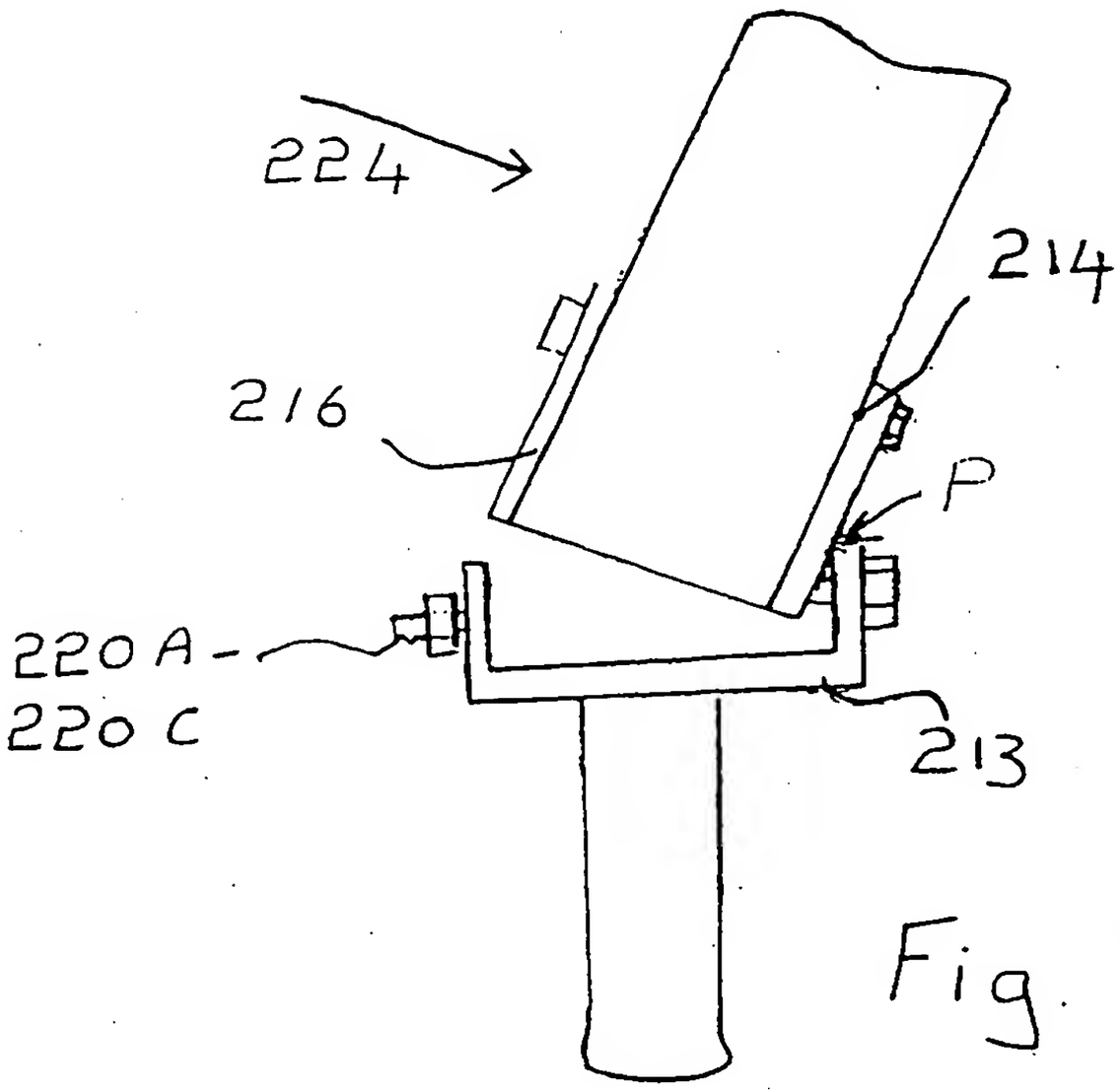


Fig. 31

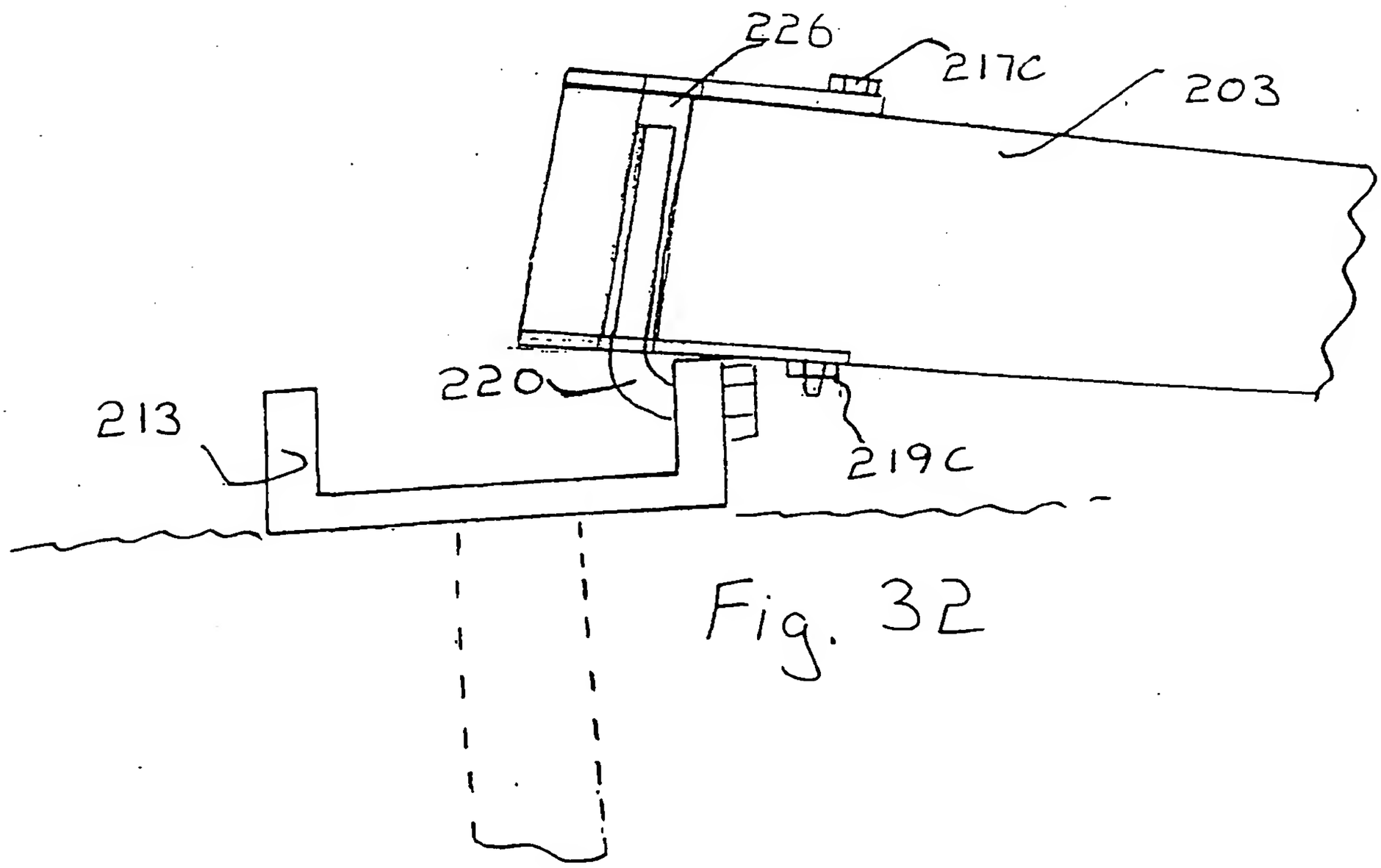


Fig. 32

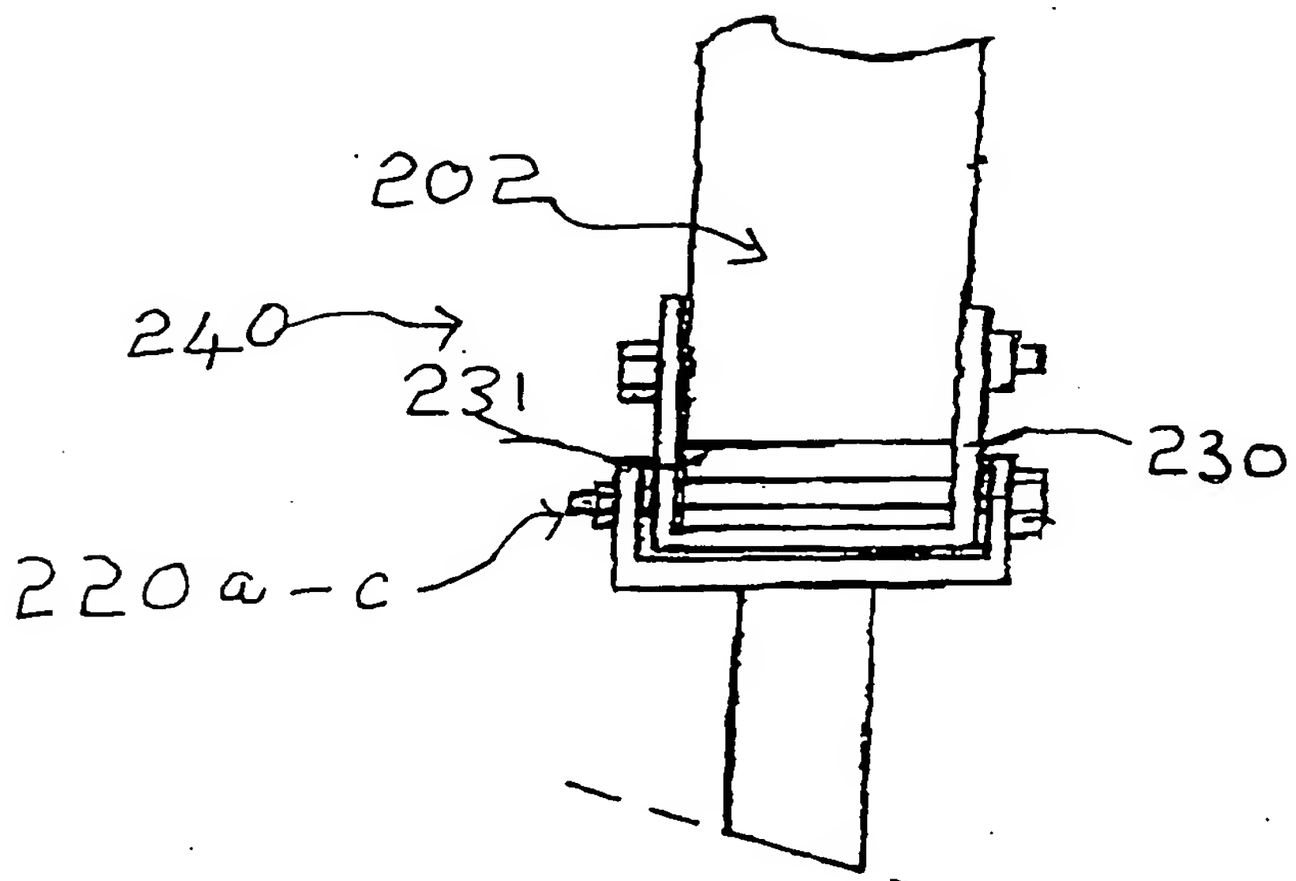


Fig. 33

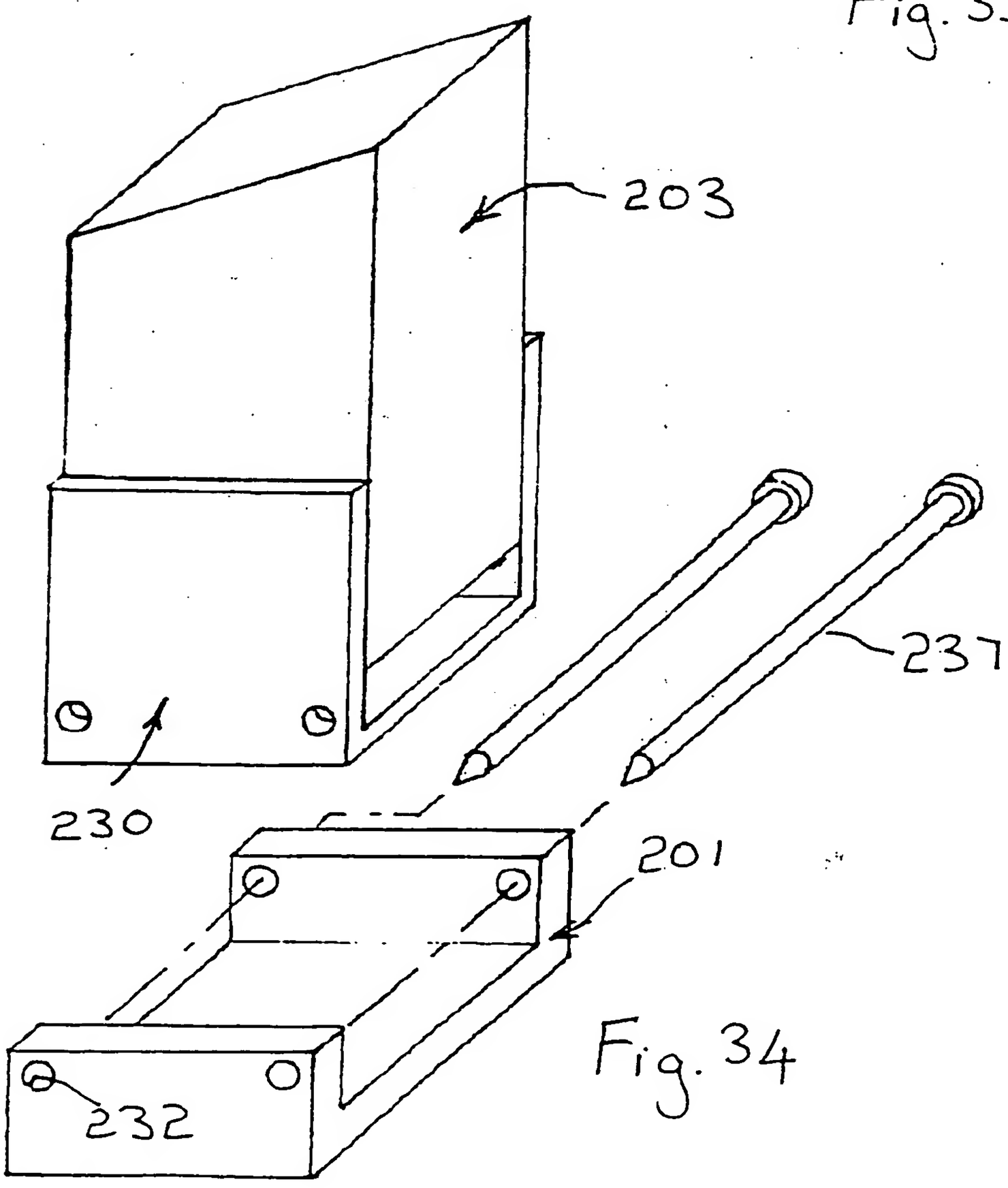


Fig. 34

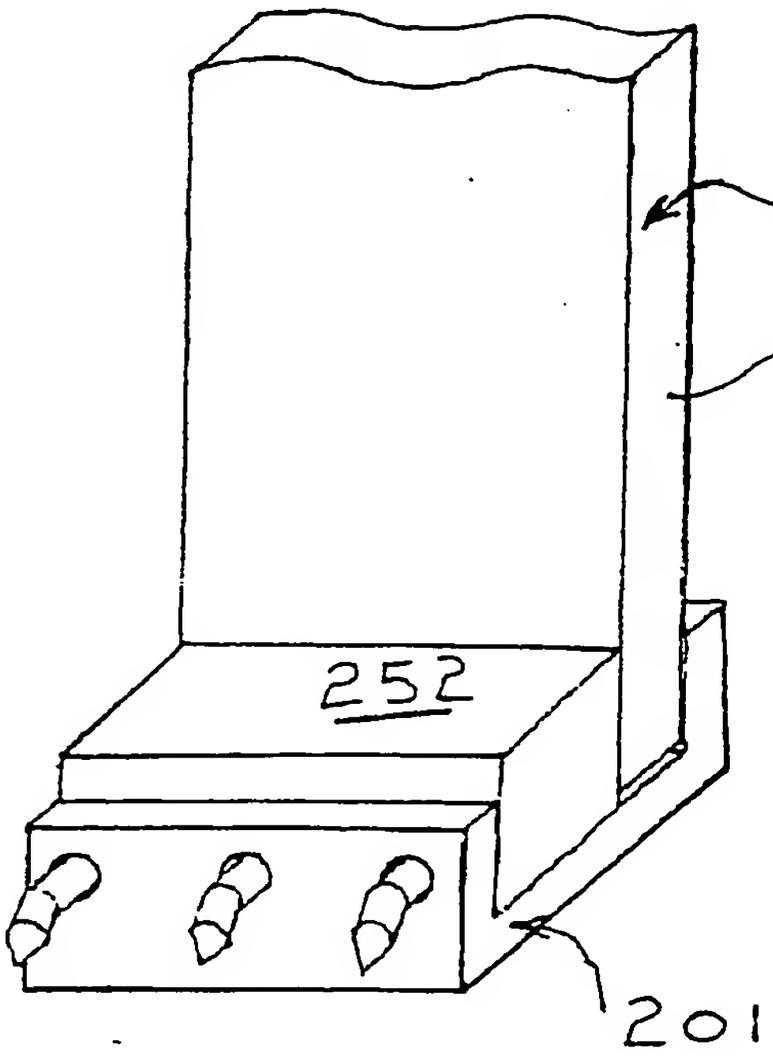


Fig. 35

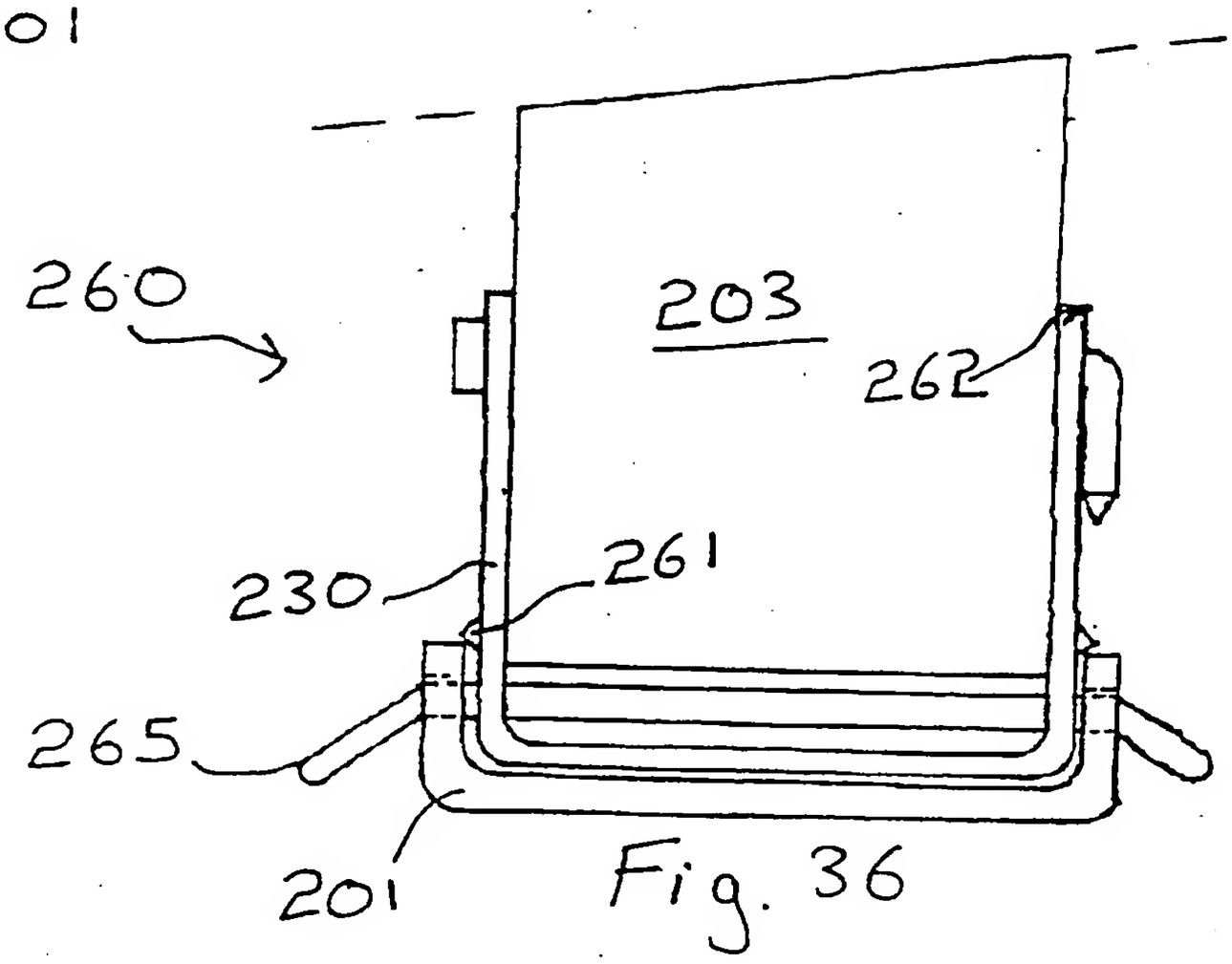


Fig. 36

Fig. 37

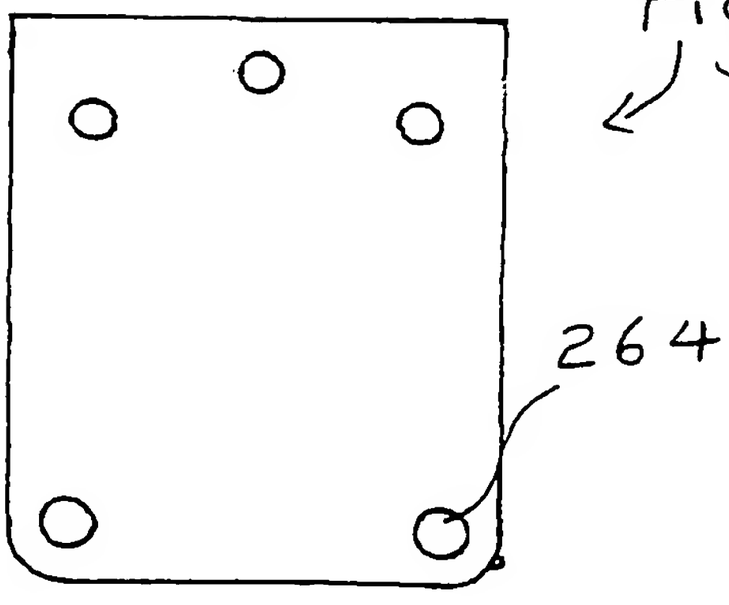
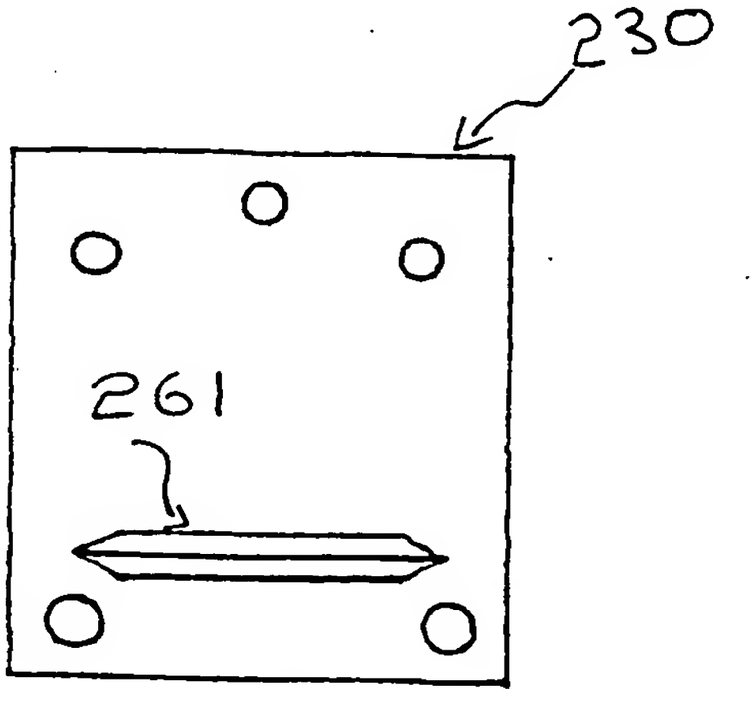


Fig. 38



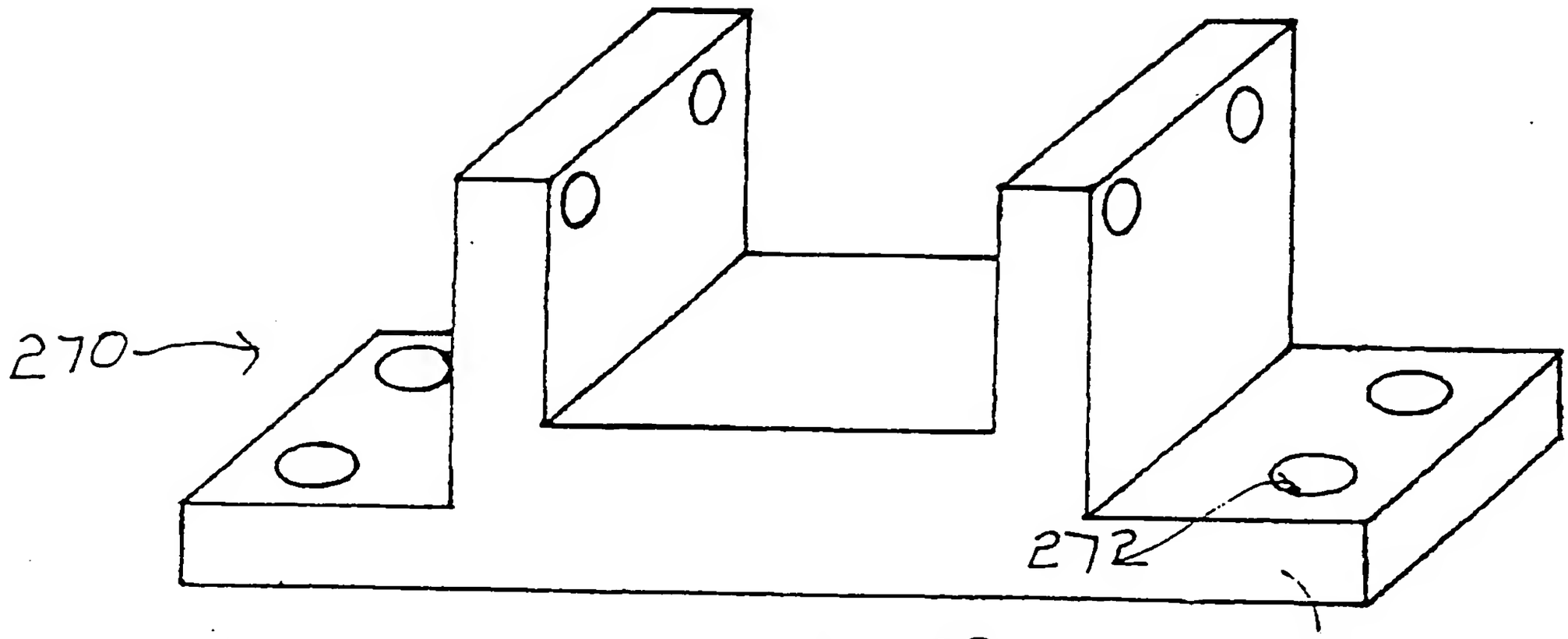


Fig. 39

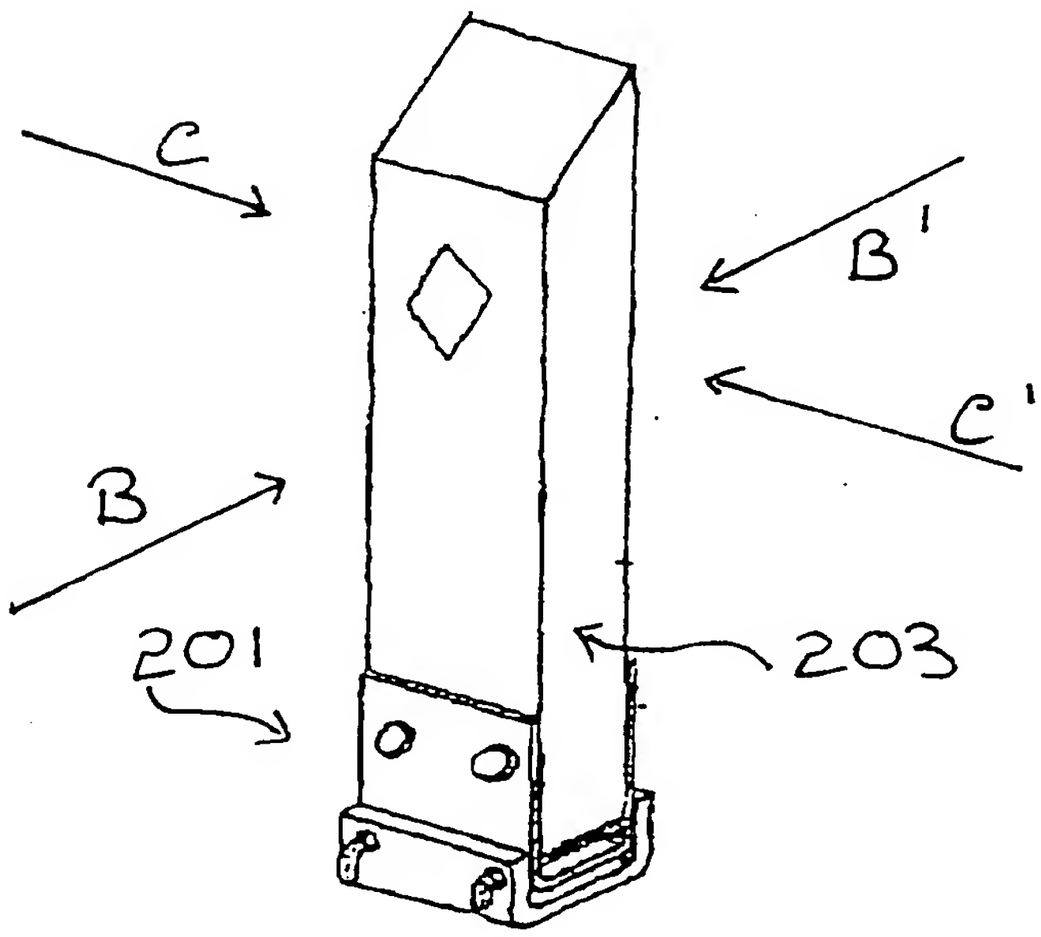


Fig. 40a

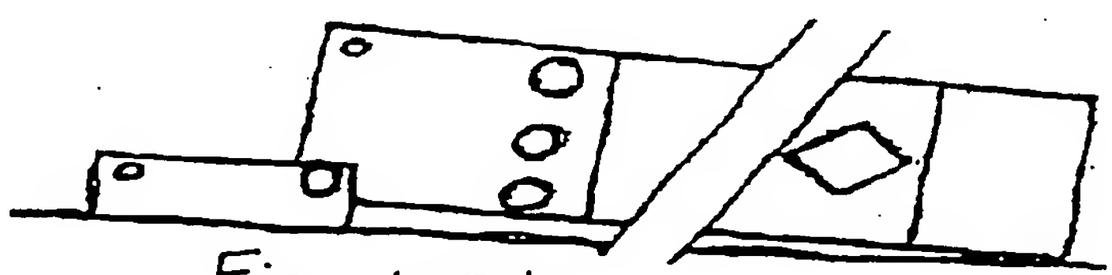


Fig. 40b

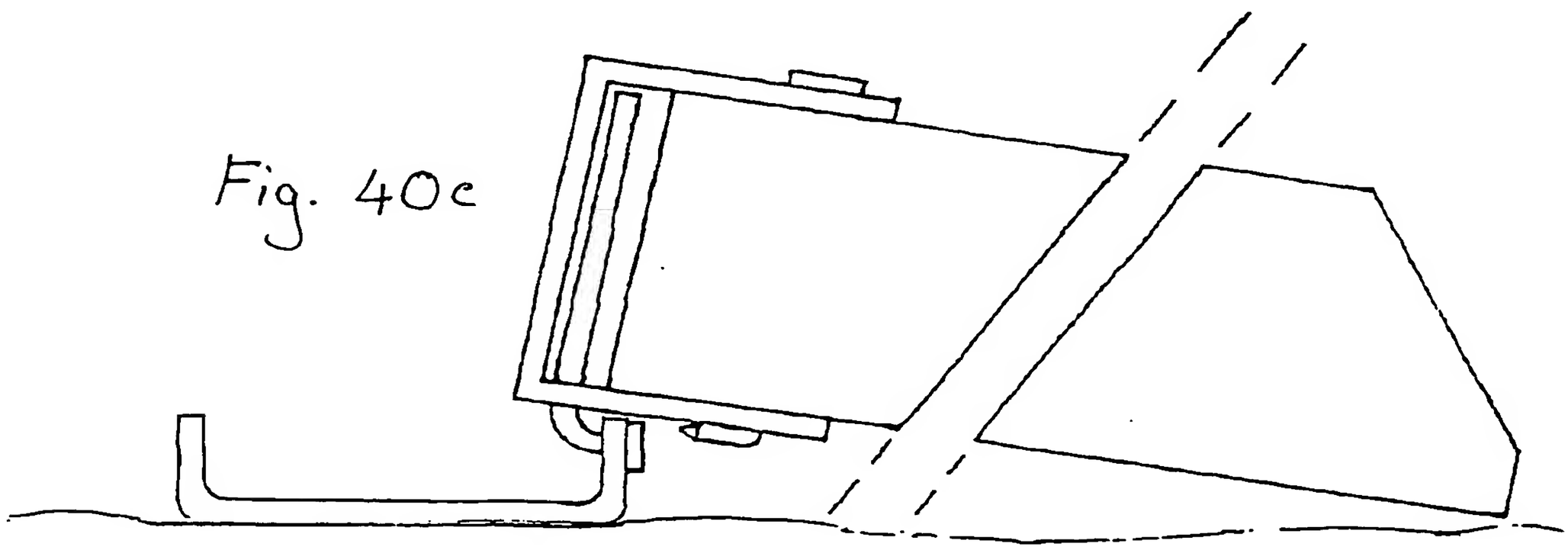


Fig. 40c

INTERNATIONAL SEARCH REPORT

International application No.
PCT/AU00/01522

A. CLASSIFICATION OF SUBJECT MATTER

Int. Cl. [7]: E02D 5/80, 5/54

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC E02D 5/80, 5/74, 5/54

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
AU: IPC AS ABOVE

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
WPAT: FLANGE+ or RIM+ or PROJECTION+ or RAISED+ or BULGE+ or FIN+ or FLAT+ or WIDENED

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	EP 677630 B1 (MAUREAU et al) 18 October 1995 Whole document	1-3, 7, 15, 17 and 18
X	US 5148641 A (RUSHING et al) 22 September 1992 Column 3, line 4 - column 5, line 32 and figures 1-2	1-3, 7, 15, 17 and 18
X	WO 95/14147 A1 (LINDBERG) 26 May 1995 Whole document	1-3, 7, 15, 17 and 18

[X] Further documents are listed in the continuation of Box C [X] See patent family annex

* Special categories of cited documents:

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier application or patent but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
26 March 2001	5 April 2001
Name and mailing address of the ISA/AU AUSTRALIAN PATENT OFFICE PO BOX 200, WODEN ACT 2606, AUSTRALIA E-mail address: pct@ipaustralia.gov.au Facsimile No. (02) 6285 3929	Authorized officer L Filipovic **LEOPOLD FILIPOVIC** Telephone No : (02) 6283 2105

INTERNATIONAL SEARCH REPORT

International application No.
PCT/AU00/01522

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	DE 3507269 A (LICHTENBERG) 22 May 1986 Whole document	1-3, 7, 15, 17 and 18
X	FR 2737525 A1 (MORALY) 7 February 1997 Whole document	1-3, 7, 15, 17 and 18
X	US 3969853 a (DEIKE) 20 July 1973 Figure 2	1-3, 7, 17 and 18

INTERNATIONAL SEARCH REPORT

International application No.
PCT/AU00/01522

Box I Observations where certain claims were found unsearchable (Continuation of item 2 of first sheet)

This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos :

because they relate to subject matter not required to be searched by this Authority, namely:

2. ☐ Claims Nos :

because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:

3. ☐ Claims Nos :

because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a)

Box II Observations where unity of invention is lacking (Continuation of item 3 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

1. Claims 1-3, 7, 15, 17 and 18
2. Claims 8 and 9
3. Claims 10-14
4. Claims 4-6 and 16 as reasoned on the extra sheet.

1. ☐ As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims
2. ☐ As all searchable claims could be searched without effort justifying an additional fee, this Authority did not invite payment of any additional fee.
3. ☐ As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:

4. ☒ No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:
1-3, 7, 15, 17 and 18.

Remark on Protest

☐ The additional search fees were accompanied by the applicant's protest.

☐ No protest accompanied the payment of additional search fees.

INTERNATIONAL SEARCH REPORT

International application No.
PCT/AU00/01522

Supplemental Box
(To be used when the space in any of Boxes I to VIII is not sufficient)

Continuation of Box No: II

The international application does not comply with the requirements of unity of invention because it does not relate to one invention or to a group of inventions so linked as to form a single general inventive concept. In coming to this conclusion the International Searching Authority has found that there are different inventions as follows:

1. Claims 1-3, 7, 15, 17 and 18 are directed to an earth anchoring member and a method of driving an earth anchoring member. It is considered that the feature of "the ground engaging portion having a leading edge and opposed ground retaining flanges which extend at least initially outwardly from the upper body" comprises a first "special technical feature".

2. Claims 8 and 9 are directed to a stabilizing collar. It is considered that "the outwardly curved stabilizing surface" comprises a second "special technical feature".

3. Claims 10-14 are directed to a post assembly operative to yield during impact. It is considered that "the collision release means and the post member retaining means" comprise a third "special technical feature".

4. Claims 4 and 5 combine the features defined in claims 1, 10 and 11, claim 6 combines the features defined in claims 1 and 8, while claim 16 combines the features defined in claims 8 and 15.

Since the above-mentioned groups of claims do not share any of the technical features identified, a "technical relationship" between the inventions, as defined in PCT Rule 13.2 does not exist. Accordingly, the international application does not relate to one invention or to a single inventive concept, a priori.

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/AU00/01522

This Annex lists the known "A" publication level patent family members relating to the patent documents cited in the above-mentioned international search report. The Australian Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

Patent Document Cited in Search Report		Patent Family Member					
EP	677630	FR	2718782				
US	5148641	CA	2071418				
WO	95/14147	AU	41228/96	BR	9408095	EP	731869
		SE	9303845				
DE	3507269	NONE					
FR	2737525	NONE					
US	3969853	NONE					

END OF ANNEX